AMERICAN

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Official Publication of the Proceedings of the American Association of Textile Chemists and Colorists

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Editor of Proceedings

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MARCH 31, 1952
VOLUME 41 NUMBER 7

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AMERICAN
DYESTUFF REPORTER

VOLUME 41 MARCH 31, 1952 NUMBER 7

IMPORTANT CHARACTERISTICS OF WOOL OIL*

B A RYBERG
Textile Research Department
Procter & Gamble Company

INTRODUCTION

BEFORE discussing the "important characteristics of wool oils" I think it would be well to review the functions of wool oil.

Wool oil is necessary for the following reasons:

1) To lubricate fibers during carding and hold fiber breakage to a minimum.
2) To control static and keep fly and waste down.
3) To assist in rubbing and hold the rub in the roping.
4) To assure a uniform draw and twist insertion in spinning.

The ideal oil is one that produces good yarn which, in turn, assures good winding, warping and weaving. It should be resistant to oxidation, easily removable in finishing and capable of producing uniform piece dyes.

The subjects I want to discuss briefly are: wool oil emulsions and their behavior, carding, oil shrinkage or loss in carding, static control and fly, moisture, card stripping, oil usage and yarn strength, tape life, apron scale, effect of dyestuffs, spinning, and, lastly, finishing.

DISCUSSION

WOOL OIL EMULSIONS AND THEIR BEHAVIOR——The subject of wool oil emulsions and their behavior is certainly of interest to all of you. Definite advantages are afforded when wool oils are self-emulsifiable, such as the savings in time of preparation as well as in steam. They should yield emulsions of good stability so as to assure uniform concentration of oil in the emulsion. Some types of self-emulsifiable oils give very stable emulsions which spread quickly and evenly and do not break on contact with the wool. Thus, full advantage may be taken of both oil and water.

B A Ryberg

The author, formerly Associate Director of Research of AATCC for fifteen years, discusses the behavior and important characteristics of wool oil as observed in operation in a number of woolen mills. Wool oils are of importance to dyers and finishers as they should be resistant to oxidation, easily removable in finishing, and capable of producing uniform piece dyes.

Some self-emulsifiable oils produce quite stable emulsions, which break, however, on contact with the wool and allow the moisture to settle at the bottom of the bin, the oil going its own way.

Moisture at the bottom of the bin leads to many complications. It produces uneven roping weights due to variation in the moisture content of the wool. If the oil itself has poor keeping qualities the moisture will promote "heating in the bin," something all of you no doubt have experienced at one time or another. "Heating in the bin" is usually an indication that oxidation is taking place. Bacterial growth is also promoted when the water settles to the bottom of the bin and heat is generated, due to the poor keeping qualities of the oil.

Since there are many disadvantages in emulsions that break on contact with the wool, the ideal oil, therefore, should produce stable emulsions. These emulsions should spread quickly and evenly so as to "condition the stock" for carding and make it possible to card immediately after picking. Furthermore, the ideal oil should be able to hold the moisture, should the picked stock have to be stored for one reason or another before carding. It should not cause heating in the bin under any circumstances.

CARDING——One of the most important characteristics of a wool oil is its ability to give good carding. Since fiber breakage should be kept at a minimum, the stock kept under control at all times, and the roping kept free of pills or nibs, the oil must have excellent lubrication properties.

Uniformity of roping weights is extremely important and it should be held within narrow limits from spool to spool and also within a spool.

OIL SHRINKAGE IN CARDING——The shrinkage or loss of oil in carding is something about which little appears to be known. Perhaps many of us do not fully realize that wool oils vary considerably in the amount they "shrink" in picking and carding. By this I mean actual loss of oil. The first time I ran into a high shrinkage oil I could hardly believe what I saw. However, in the years since, I have found that there is a great deal of variation in the shrinkage of wool oils. Table I shows the shrinkage of eight different wool oils. These results were obtained from actual plant runs and as you can see, show a great deal of variation from one oil to another. Please note that any given oil will vary somewhat in shrinkage from mill to mill, depending on the conditions in the particular mill, such as the length of time that picked stock is allowed to stand before carding, speed of cards, humidification, etc. It goes without saying that the oil showing the least shrinkage would be most economical to use, all other things being equal. I shall not attempt to explain the mechanism involved in the loss of oil in carding, but part of it is no

* Presented before the Carder's Guild Section meeting of the National Association of Woolen and Worsted Overseers at Hotel Manger, Boston, Massachusetts, November 9, 1951.

TABLE I

SHRINKAGE OR LOSS OF WOOL OIL IN PICKING AND CARDING

Oil	Oil in Blend %	Oil Added to Blend in Picking %	Total Oil in Blend After Picking %	Oil Found in Roping %	Shrinkage or Loss %
A	1.0	3.5	4.4	3.9	14.7
	1.4	3.5	4.7	4.5	5.9
B	1.0	4.5	5.3	3.2	48.8
	1.4	6.0	7.0	5.3	30.0
C	1.2	4.7	5.6	4.0	35.5
D	0.8	7.8	8.0	4.5	48.0
E	4.0	7.5	10.7	8.3	34.0
F	0.9	9.0	9.1	5.0	49.7
G	0.6	7.5	7.5	6.1	20.0
H	1.3	6.5	7.3	5.5	29.5

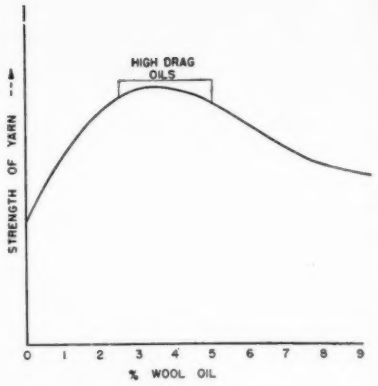

Figure 1
Correlation of % Wool Oil With Strength of Yarn

doubt due to volatile components in the oils.

Roping should be well condensed or rubbed so as to give good spinning. Some oils give a harder rub than others. The type of rub to be given roping (i e, hard or soft) will depend on the purpose for which the yarn is intended. The rub is definitely affected by the amount of oil in the stock at the condenser aprons, which in turn will depend on the type oil and its shrinkage characteristics.

STATIC CONTROL——Static is a problem, particularly in the winter time, and can cause a considerable loss of production, especially in starting up on Monday morning. It usually shows up first on the Peralta rolls, where the web tends to stick and usually lap around the small roll. Naturally, breaks in the web will give uneven work. The ideal wool oil in this case should be able to prevent lapping on the Peralta roll as well as to hold fly down to a minimum. It should also be able to control the static buildup in the aprons and deliver "well behaved" roping at all times.

Many oils that card well in the summer cause trouble in the winter, particularly in card rooms that are not humidified, because of their inability to prevent the buildup of static.

When blends of wool and the newer fibers are being run and static problems are consequently much more severe, it is important that a good antistatic oil be used. There may even be occasions when it is desirable to add a small amount of a good antistatic agent to the emulsion, particularly where the amount of emulsion used must be kept low to prevent balling.

The newer fibers are very sensitive to water, absorbing very little as compared to wool, and as a result low water-to-oil emulsion ratios must be used. Furthermore, less oil is used than in the case of all-wool blends. Since less oil can be used and static is more acute with these new fibers, the use of a good antistatic oil is all the more important. Static will always be with us, but you can minimize your troubles by using the right oil.

FLY——Fly should be kept to a minimum consistent with good work. Oils which lose moisture and dry out quickly or shrink badly will allow excessive fly unless the stock is loaded with oil.

A high-drag type of oil with low shrinkage, when properly used, will consistently show a minimum of fly and, as a result, less card waste. This naturally leads to higher yields.

The ideal oil in this case should be able to hold down fly even after the oiled stock has been stored for some time prior to carding and yet should be able to condition the stock almost immediately so that it can be carded right after picking, if necessary.

With today's production so unsettled, it is highly desirable that an oil be used that can be carded either immediately or after lying in a bin several days. Oiled stock which has dried out and must be picked again suffers considerably in quality as a consequence.

MOISTURE——Moisture plays a very important part in carding. More than just keeping the fly down, it helps soften or plasticize the fibers and makes them easier to card. We have always felt that moisture was essential to good work and this is substantiated by the fact that conditioning of card rooms improves both the carding and spinning efficiencies. Fibers are more easily controlled, static and fly are reduced, and better rubbing is obtained. Carders vary greatly on their ideas relative to moisture content of the picked stock. Some like it quite damp, others quite dry, and still others in between. Some feel that their roping weights can be better controlled by keeping the moisture to a minimum, which means low water-to-oil ratio emulsions, such as 1:1 or 1.5:1.

The ideal oil in this case is one which loses moisture slowly and uniformly while producing uniform roping weights. Such an oil can be used as a six-to-one emulsion and in some cases even as an eight-to-one emulsion.

The conditions in any particular mill will, of course, govern what emulsion ratio to use. Three-to-one emulsions of the conventional oil are probably used more than any other. Six-to-one emulsions represent the average for the high drag or self-scouring type of oil.

CARD STRIPPING——The question of stripping is always of interest. Many times the hard stripping of cards can be traced to excessive use of high drag or "self-scouring" oils. When these oils are used in correct amounts, as recommended by their manufacturers, stripping is normal.

Some types of oils tend to accumulate in the card strippings, which makes it harder to reclaim or reuse this waste. Card waste should be kept low and stripping done as often as necessary to produce consistently good work.

There is a great difference of opinion among carders as to the proper time to strip. Consistently good work calls for fairly frequent stripping.

OIL USAGE AND YARN STRENGTH——Speaking of high drag or self-scouring type oil, this added drag makes the oil go farther, that is, where 7-8% of the conventional oils are needed for best carding and spinning, only 3-4% of the self-scouring type are needed. If more is used, the results will not be as good as illustrated in Figure 1. Here we take strength as a measure of the quality of the yarn and plot it against the amount of oil used. Note that the maximum strength (and maximum carding efficiency) is obtained in the 3-4% range with this particular oil and that the larger amounts of oil produce definitely weaker yarn. When more oil is used, carding is not as good and the roping produced is usually nibby or pilly. This curve represents information collected from a large number of mills over the past three years.

Figure 2 shows the relationship between the strength of the yarn and the amount of oil for conventional oils. Here we see that

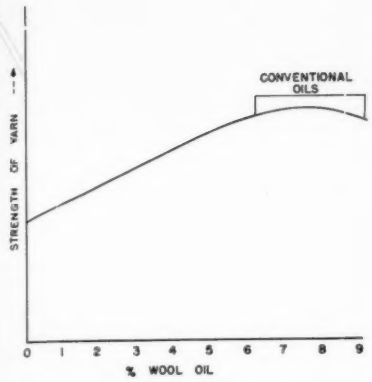

Figure 2
Correlation of % Wool Oil With Strength of Yarn

maximum yarn strength is obtained with 7-8% of the conventional type oils. Note that the maximum yarn strength for the conventional oils is not as high as for the high-drag oil. These figures will probably explain why the high-drag oils fail to produce the results expected when they are run like conventional oils.

Where yarn strength is important, the high-drag oil will get you "over the hump" when the ordinary oil can't make the grade. Furthermore, greater yields are consistently obtained with these oils if properly used. It is seldom possible to "have one's cake and eat it" and in order to obtain all of the desirable characteristics of increased yields, strength, etc, that these high-drag oils offer, the less-desirable effect on tape life has had to be taken along with them. The advantages to be gained from these oils far outweigh any disadvantage, however, and it boils down to deciding which are the most important.

TAPE LIFE——Tape life has been discussed at some length at the last two meetings of this group and it has been the consensus of opinion that some of the present so-called self-scouring oils tend to shorten tape life when used in excess. Truly self-scouring wool oils, in order to be made to perform as such, must of necessity contain relatively large amounts of emulsifiers, many different types of which may be used to give the added drag and easy scouring.

Recent research, development, and testing have shown that oils can be produced that are very easily removed in scouring, while having no deteriorating effect on leather tapes and aprons. In fact, they tend to preserve the leather. Such oils keep the tapes alive, retain pliability, avoid ragginess and mushiness and result in longer tape life.

In general, these recently-developed oils do not have the high drag of the other type, and more of the oil can be used without gumming up the cards. They can be used in relatively high percentages to provide surface lubrication, which is so important for knitting yarn that is to be run on spring beard needles.

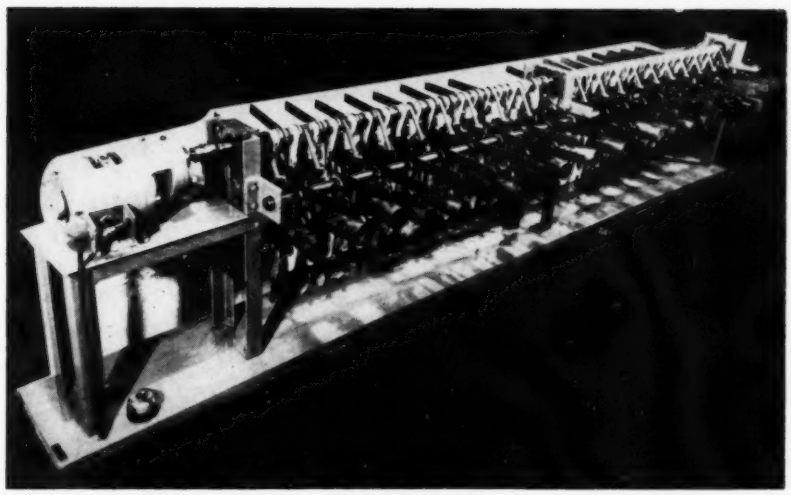

Figure 3

Figure 3 shows a "tape-testing" machine specifically designed by our Textile Research Department and built to test various kinds of tapes, as well as various wool oils. Accelerated wear or breakdown of the tapes is obtained by the use of one-inch diameter shafts, which cause a much sharper bending of the tape than that obtained with the regular tape condenser. By means of this machine, tapes can be tested for durability in a relatively short time. Fifteen days on this machine will show up poor tapes or oils which are injurious to the leather. Thirty days on the machine will give you tapes that look like those in Figure 4. The tape on the right, produced by treating for 30 days with one type of self-scouring oil, shows the surface cracks with which you are all familiar. The tapes on the left were also treated daily for 30 days with a different type of easy-scouring oil, recently developed. As you can see, this oil has practically no effect on the tapes. In fact, it has been used to reclaim hardened glazed aprons. These laboratory results have been confirmed by plant tests where the oils have been in use for twelve months. Remember that the tapes in Figure 4 were given accelerated tests.

This tape-testing machine has made it possible to test different kinds of tapes, as well as the effect of a variety of compounds on tape life. One of the most surprising things found was the great variation in leather. This is not surprising, however, when you consider that leather is made from the skin of animals and will vary in durability, depending on that part of the animal from which it is taken.

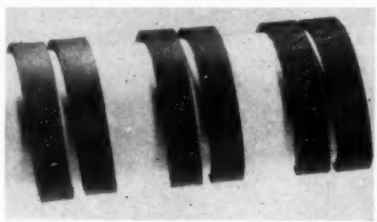

Figure 4

We have seen instances where scouring assistants were added to the wool oil to assure its removal in scouring. These added materials shorten tape life noticeably. Highly alkaline stocks have been found to affect the tape life adversely, as have some of the spinning assistants. Overstretching definitely shortens tape life as will improper or infrequent oiling of the aprons and tapes. These all show that in many cases oils have probably been blamed for poor tape life when the trouble lay elsewhere.

APRON SCALE——Many or perhaps all of you have encountered apron scale or gumming of the fancy wire or doffer comb at some time or other and have wondered if the wool oil was the cause. In several instances, we have found this to be caused by damaged wool in the blends. Figures 5—10 serve to illustrate different kinds of damaged wool that we run across at some time or other.

Figure 5 shows how normal wool looks under the microscope. It shows the usual scales on the fiber and the variations in fiber diameter.

Figure 6 shows short, broken-off pieces of fiber. These show up as a scale on the rub aprons also. This scale was extracted with ether to remove the oil and grease, and a gray powder, much like Portland cement in appearance, was left, which, when examined under the microscope, proved to be the broken fibers.

What was the cause of this condition?

Checking of the blend sheets showed that a considerable amount of pulled wool was being used. Tests showed that the root ends were brittle and easily broken off due to improper pulling. The sulfide depilatory had been allowed to work up in the fiber roots

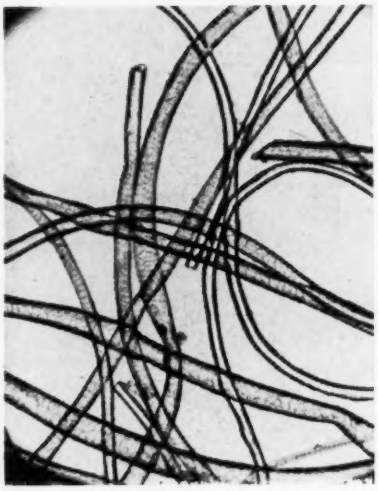

Figure 5

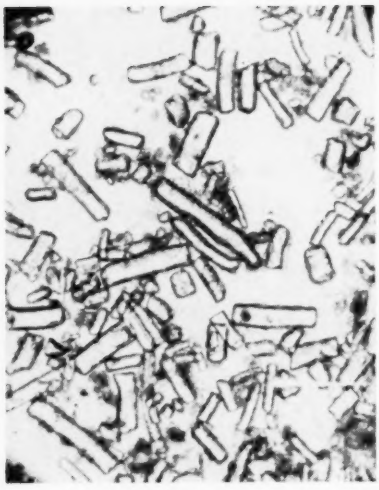

Figure 6

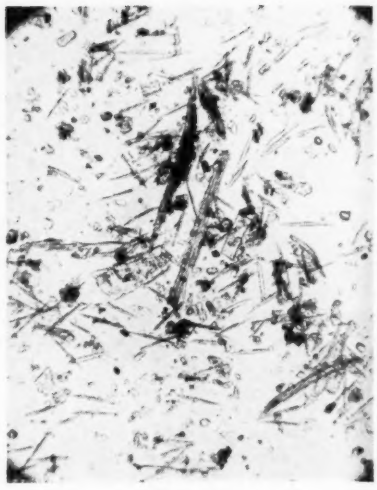

Figure 7

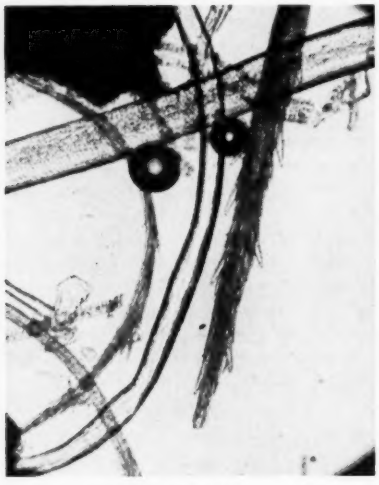

Figure 8

Figure 9

Figure 10

and damage the wool, accounting for the brittle root end which finally showed up in the form of scale.

Figure 7 illustrates the deteriorating effects of bacteria on wool, also obtained as scale on the rub apron. Notice the splinters that serve as the building blocks or bricks which make up the wool fiber. The particular type of bacteria which caused this damage did so by eating the cementing material between the splinters or blocks and thereby allowing the fiber to disintegrate. A piece of fiber in the middle of the illustration is actually going to pieces. Note the spindle cells or splinters coming apart.

An investigation of the wools being used showed that some of them were already partly damaged by the bacteria when received by the mill. Sometimes bacteria get started in the storage bin when the moisture content and the temperature are just right and show up in this form.

Figure 8 shows the scales coming loose from the fiber, due again to bacteria of another type.

Figure 9 shows another type of damage caused in carbonizing. Again we see the short fiber pieces, some with definite cracks across the fiber.

Figure 10 shows what happens to wool when overstripped. By stripping, I mean the process of stripping dyestuff from the fiber as part of the procedure for reclaiming the fiber. Note how the fiber breaks off. This type of fiber is very brittle and will break up badly in carding, giving a lot of dust.

EFFECT OF DYESTUFFS——You are all familiar with the weakening effect of chrome dyes on wool and the necessity for having to use more emulsion to overcome the dry, harshening effect of the dyes. There is some yarn made from wool stock dyed with chrome dyestuffs. The mill making this yarn has all new equipment but was unable to get the yarn strength necessary to get through winding, warping, and weaving, using a popular conventional oil.

This was a natural for the high-drag type of oil. Such an oil was tried and resulted in a strength increase of 15%, an increased yield of 5%, and greatly improved operations on the automatic winders and in warping. Weaving efficiency was boosted considerably. This was a case of "getting over the hump". It resulted in greatly increased production and meeting of schedule commitments.

SPINNING——In spinning, the ideal oil should draw smoothly and evenly and help produce a uniform yarn. Spinning, to be efficient, must contend with a minimum of ends down. Where strength is important, oils of the high-drag type are to be preferred, so as to produce the necessary strength to get through winding, warping, and weaving. The ability of an oil to hold moisture should not be overlooked in this operation. Roping that can be satisfactorily spun after lying around for several days is

(Concluded on Page 213)

Proceedings of the
American Association of Textile Chemists and Colorists

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MARCH 31, 1952

AATCC CALENDAR

COUNCIL: April 18 and June 13 (New York); Sept 19 (Philadelphia); Nov 6 (Boston).

GENERAL RESEARCH COMMITTEE: Dates and sites are the same as the Council's.

NATIONAL CONVENTIONS: 1952—November 6-8, Boston, Mass: 1953—Sept 17-19, Hotel Conrad Hilton, Chicago, Ill; 1954—Atlanta, Ga.

HUDSON-MOHAWK SECTION: May 2 (Jack's Restaurant, Albany, N Y); June 20 (Annual Outing).

MID-WEST SECTION: April 19 (Hotel Netherlands Plaza, Cincinnati, O); June 14 (Lake Lawn Lodge, Delavan, Wisc); October 4 (Hotel Bismarck, Chicago, Ill).

NEW YORK SECTION: April 18 (Swiss Chalet); May 16 (Swiss Chalet); June 13 (Outing, North Jersey Country Club).

NORTHERN NEW ENGLAND SECTION: April 18 (LTI); May 16 (Andover Country Club); June 6 (Annual Outing, Merrimack Valley Country Club); Dec 6 (1952 Annual Meeting, LTI).

PHILADELPHIA SECTION: April 25 (Abraham Lincoln Hotel, Reading, Pa); June 13 (Outing, Lu Lu Temple Country Club, North Hills, Pa).

PIEDMONT SECTION: April 26 (Clemson Hotel, Clemson, S C); June 6-7 (Ocean Forest Hotel, Myrtle Beach, S C); Sept. 13 (Hotel Charlotte, Charlotte, N C).

RHODE ISLAND SECTION: April 25 (Wannamoisett Country Club); May 23 (Providence Engineering Society); June 6 (Annual Outing—Wannamoisett Country Club); Oct 24 (Providence Engineering Society); Dec 5 (Annual Meeting, Sheraton-Biltmore, Providence).

SOUTH CENTRAL SECTION: May 17 (Patten Hotel, Chattanooga, Tenn); Aug 22-23 (Summer Outing, Chattanooga Golf and Country Club); Dec 6 (Patten Hotel).

WESTERN NEW ENGLAND SECTION: May 2 (Ladies Night, Cheshire, Conn); June 20 (Outing); Oct 3, Nov 14 and Dec 12 (Rapp's).

OTHER EVENTS

ACHEMA X

Exhibition Meeting for Chemical Engineering, May 18-25, Frankfort/M, Germany.

AMERICAN CHEMICAL SOCIETY

7th National Chemical Exposition, Sept 9-13, Chicago Coliseum, Chicago, Ill. This will include the 2nd International Art Exhibit.

AMERICAN OIL CHEMISTS SOCIETY

Forty-third Annual Meeting, April 28-30, Shamrock Hotel, Houston, Texas

Short Course industrial trips, July 8-9, 10-11.

AMERICAN SOCIETY FOR QUALITY CONTROL

Sixth Annual Convention, May 22-24, Syracuse, New York.

AMERICAN SOCIETY FOR TESTING MATERIALS

Annual Meeting, June 23-27, 1952, New York. N Y. (The biennial Apparatus and Photographic Exhibits will be held in conjunction with this meeting).

1953—Spring Meeting (Hotel Statler, Detroit, Mich.)

Annual Meeting (Chalfonte-Haddon Hall, Atlantic City, N J.)

1954—Spring Meeting (Shoreham Hotel, Washington, D C)

Annual Meeting (Sherman Hotel, Chicago, Ill.)

AMERICAN STANDARDS ASSOCIATION

3rd National Standardization Conference, Sept 8-10, Museum of Science and Industry, Chicago, Ill.

34th Annual Meeting, November 19, Waldorf-Astoria, New York, N Y.

BRITISH INDUSTRIES FAIR

May 5-16, London and Birmingham, England.

CANADIAN ASSOCIATION OF TEXTILE COLOURISTS AND CHEMISTS

Annual Meeting (Quebec Section) April 25-26, Mount Royal Hotel, Montreal, Que.

CANADIAN TEXTILE SEMINAR

September 11-13, Queen's University, Kingston, Ont.

CHICAGO INTERNATIONAL TRADE FAIR

Mar 22-April 6, Navy Pier, Chicago, Ill.

FIBER SOCIETY

Meeting: April 16-17, 1952 (Clemson House, Clemson, S C); Sept 10-11 (Princeton, N J).

LEIPZIG FAIR

September 7-17, Leipzig, Germany.

NATIONAL ASSOCIATION OF HOSIERY MANUFACTURERS

41st Knitting Arts Exhibition, April 27-May 1, 1953, Atlantic City Auditorium, Atlantic City, N J.

NATIONAL KNITTED OUTERWEAR ASSOCIATION and UNDERWEAR INSTITUTE

Knitting and Allied Crafts Exposition, April 21-25, Grand Central Palace, New York, N Y.

AMERICAN TEXTILE MACHINERY ASSOCIATION

Exhibit of American Textile Machinery, April 26-May 1, 1954, Atlantic City Exhibition Hall. Atlantc City, N J.

NEW YORK BOARD OF TRADE

26th Annual Meeting: September 25-28, Pocono Manor Inn, Pocono Manor, Pa.

NORTH CAROLINA STATE COLLEGE

Textile Open House, April 5, School of Textiles, Raleigh, N C.

PHI PSI FRATERNITY

49th Annual Convention, May 1-3, Clemson House, Clemson, S C.

PURDUE INDUSTRIAL WASTE CONFERENCE

May 7-9, Purdue Memorial Union, Purdue University, Lafayette, Indiana.

SOCIETE DE CHEMIE INDUSTRIELLE

25th International Congress for Industrial Chemistry, May 18-25, Paris, France.

THE WOOL BUREAU, INC

International Wool Research Project Seminar, April 7-9, Lowell Textile Institute, Lowell, Mass.

TEXTILE INSTITUTE

Annual Conference, June 2-6, Edinburgh, Scotland.

EMPLOYMENT REGISTER

This column is open for two insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the Secretary of the Association, Lowell Textile Institute, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the Secretary.

52-10

Education: Chemistry & dyeing, Philadelphia Textile Institute, night school.

Experience: Dyehouse foreman, yarns of all fibers.

Age: 40; married; veteran.

3-17, 3-31

52-11

Education: BS, Textile Engineering, Lowell Textile Institute.

Experience: Mill liaison with selling office.

Age: 24; single; position as textile engineer in production or sales co-ordination desired; location immaterial.

3-17, 3-31

52-13

Education: BS with graduate work in chemistry.

Experience: Chief chemist, dyes and intermediates.

Age: 49; married; references; vicinity of New York preferred.

3-31, 4-14

Meeting Report—Philadelphia Section

March 7, 1952
Penn-Sheraton Hotel, Philadelphia, Pa

THE second meeting of the 1952 season of the Philadelphia Section was held Friday, March 7, 1952, in the main ballroom of the Penn-Sheraton Hotel in Philadelphia.

A record attendance was achieved for a Philadelphia Section Meeting with 287 members and guests at the dinner and 350 at the technical meeting.

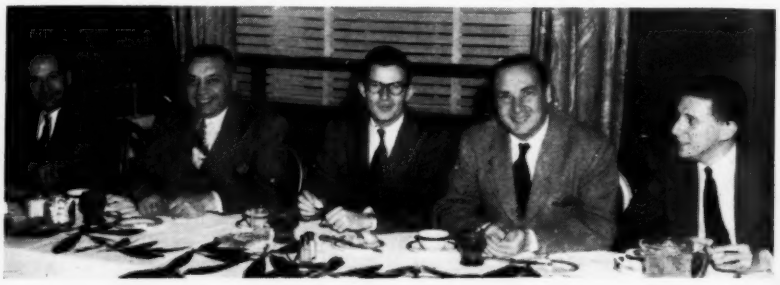
Chairman E C Diehl introduced the following guests from the New York Section: Chairman P J Luck; Vice Chairman W G Helmus; Treasurer J J Marshall; Secretary N A Johnson; Technical Program Chairman J H Hennessey; C A Whitehead and M D Reeser, Howes Publishing Co, Dr G L Royer, 1950 Olney Medalist; and E A Leonard, Alexander Smith and Sons Carpet Co. Other members of the New York Section were present.

Program Chairman T H Hart introduced Walter E Thompson, Jr, Hemingway & Bartlett Mfg Co, who spoke on "High Pressure Dyeing of Synthetic Threads" and Alexander P Roy, Dean and Sherk Co, who presented "Practical Facts & Procedures for High Temperature Dyeing of Synthetic Fibers".

A panel of experts, consisting of the two guest speakers and C Harry McCandless, Venango Eng Co, Richard C Kopp, Aberfoyle Mfg Co, Albert E Stutzke, Globe Dye Works and Jackson Bauer, Fred Whitaker Co, handled a very interesting question and answer period.

Motion pictures of the 1951 Philadelphia outing were also presented.

Respectfully submitted,
THOMAS J SCANLON, *Secretary*



(L to r): Thomas H Hart, Program Committee Chairman; A E Raimo, Councilor; S Graeme Turnbull, Jr, Councilor; Arthur W Etchells, National Vice President—Central Atlantic Region; Edmund A Leonard, New York Section.

(L to r at head table): Thomas J Scanlon, Secretary; Percival Theel, Sectional Committee; Richard B Stehle, Councilor; Paul J Luck, Chairman, New York Section; Harry L Morgan, Vice Chairman.

John L Hennessey (left), Technical Program Chairman, New York Section, and Percival Theel, Philadelphia Sectional Committeeman Engage in a Two-man Bull Session.

Part of the New York Section's "Delegation": (L to r)—J H Hennessey, Technical Program Chairman; Myron D Reeser; James J Marshall, Treasurer; and Weldon G Helmus, Vice-Chairman.

(L to r): Walter E Thompson, Speaker, and two members of the panel, Richard C Kopp and Albert E Stutzke.

(L to r): Jackson Bauer and C Harry McCandless, panel members; Alexander P Roy, Speaker; Edward C Diehl, Chairman; Thomas H Hart, Program Committee Chairman.

Other photos snapped at the Philadelphia Section Meeting.

Meeting Report—Rhode Island Section

February 29, 1952
Johnson-Hummock's Grille, Providence, R I

APPROXIMATELY 225 members and guests attended the Rhode Island Section dinner meeting at Johnson-Hummock's Grille, Providence, R I, on February 29th.

Robert D Robinson, chief chemist, Bachmann Uxbridge Worsted Corp, spoke on "Improved Processing by Spray Application", and Donald E Marnon, assistant to the technical director, General Dyestuff Corp, gave a paper entitled, "The Marhen Process—Measurement & Control of Redox in Vat Dyeing".

Respectfully submitted,
R G THOMAS, *Secretary*

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Piedmont Section Research Committee Meeting Minutes

THE Research Committee of the Piedmont Section met at the Hotel Robert E Lee, Winston-Salem, North Carolina on Saturday, February 2, 1952. Dr H Y Jennings, Chairman, presided. In addition to a quorum of the regular committee, many members of the section attended. The total attendance was approximately 50.

The minutes of the previous meeting at Greensboro, were read and approved.

The first topic of discussion concerned the work on the Catalyst Evaluation paper. H A Rutherford reported some additional work on catalyst bath stability showing the relationship between time and pH as related to the degradation of the bath. Mr Rutherford also reported some interesting observations during the extended conditioning of resin-treated all-viscose fabric. This study was suggested by earlier discussions of the committee. These findings were so intriguing as to suggest themselves as a worthy topic for a section paper. After some further discussion of the Catalyst paper it was realized that satisfactory progress was not being made, principally because results were difficult to interpret. The committee decided to pursue the study of the conditioning of resin-treated fabrics as a substitute for the Catalyst Evaluation work. Mr Rutherford's preliminary data will be repeated along with other interesting corollary affects.

The committee next discussed the proposed paper on Tear Testing. As yet the fabrics have not been secured for this work, but when this has been accomplished, Mr Truslow will suggest the amount of needed yardage to be treated at various resin concentrations. The fabric will then be treated and distributed to the laboratories mentioned in the minutes of the previous meeting for examination after suitable onditioning (at least ten days).

The work on the "antistatic" paper is in progress at Clemson. The various antistatic materials have been received and catalogued according to type and it is believed that Mr Lindsay has received the fabric for test purposes by this time. At the meeting it was suggested that we investigate the equipment used at ITT and TRI as well as the DuPont equipment and some new equipment suggested by Dexter Chemical Company.

At this point Dr Jennings adjourned the regular meeting and turned the session over to R H Souther, who is chairman of the Research Group studying stream pollution problems. Mr Souther presented some very interesting exhibits on reduction of the waste treatment problem by conservation of chemicals used in sulfur dyeing. During this period Mr Souther, as Section Chairman, also invited the section at large to participate more fully in the work of the Research Committee. Many interesting suggestions were received from the floor.

Respectfully submitted,
FRANCIS K BURR,
Secretary, Research Committee

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Meeting Report—South Central Section

February 16, 1952
Patten Hotel, Chattanooga, Tenn

A MEETING of the South Central Section was held on Saturday, February 16, at the Patten Hotel, Chattanooga, Tennessee.

The technical program included the presentation of this Section's 1951 Intersectional Contest paper, "Toward a Simple Mechanical Means of Judging Hand" by D H Gunther, Burkart-Schier Chemical Company, and a discussion of the Marhen Process by H A Webb, General Dyestuff Corporation. Walter Ridley, Textile Division of the Foxboro Company, led the discussion of the instrument involved in the Marhen Process.

An added attraction during the evening was the magic show put on by A R Thompson of the Ciba Company.

The attendance was approximately 70.

Respectfully submitted,
R W FREEZE, *Secretary*

Intersectional Contest
3rd Prize Winner—

SOME VARIABLES IN IMPROVING THE CREASE RECOVERY OF COTTON FABRICS WITH SYNTHETIC RESINS*

PHILADELPHIA SECTION

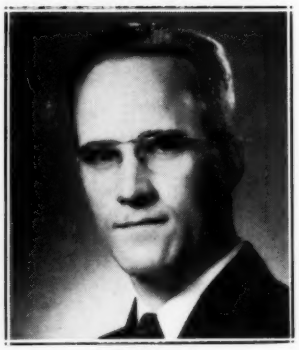
COMMITTEE
A C Nuessle
Chairman and Speaker

S W Brown
E C Diehl
R H Drukker
A W Etchells
T R Foltz
D D Gagliardi
T H Hart
L T Kelly
A L Lippert
F B Lutz
C J Monego
A E Raimo
M J Reider
F H Riale
T J Scanlon
J E Smith
R B Stehle
P Theel
F V Traut
L I Weiner
J A Woodruff

Starting with a comparison of various resin types on two cotton fabrics, this investigation was gradually extended to cover the effect of catalysis and curing conditions, pre- and after mercerization, and stiffening and softening agents, on a variety of fabrics. Because of the large number of variables, only the one desired factor (crease resistance) and a major adverse factor (tear strength) were measured. Test methods included the TBL and Monsanto crease-recovery tests and the trapezoid, Elmendorf and tongue tear tests. Fabric construction was found to be of primary importance; in most cases the strongest fabric after resin treatment was the one which had been strongest originally, but there were exceptions to this rule. Resins differed considerably in efficiency on a concentration basis; but in the more important comparison of crease recovery versus tear strength, surprisingly little difference was found between the various monomeric (diffusible) types. Surface resins (nondiffusible) did not impart crease recovery. Catalysts, similarly, varied more in efficiency than they did in improving the tear strength at a given crease-recovery level. Curing conditions were not critical over the range studied. Premercerization had only slight effect; while aftermercerization reduced the recovery and increased the tear at roughly a proportionate rate, if the fabric was not allowed to shrink. Stiffening agents tended to reduce either crease recovery or tear, or both, but a small amount of stiffener could in some cases be tolerated. Softeners tended to improve both crease recovery and tear strength, although the effect varied widely with both fabric construction and type of tearing force. Some important differences between tear tests were uncovered. It is hoped that the study, which for the most part was extensive rather than intensive, will dispel some of the mystery and misunderstanding surrounding the creaseproofing of cotton, will serve as a guide for those intending to process cotton fabrics with synthetic resins, and will indicate the paths along which further investigation is likely to be worthwhile.

INTRODUCTION

IT HAS been widely recognized for a great many years that fabrics made from wool have a natural ability to recover from creases and wrinkles incurred during use. Likewise, during the past two decades it has repeatedly been demonstrated, on a very extensive scale, that the crease resistance of viscose-rayon fabrics may be greatly improved by treatment with synthetic resins; and a number of articles have appeared in the literature describing the types of resins which may be employed, the mechanism by which they are believed to act, and the conditions under which they are best applied (*1, 2, 3, 4, 6*). But the large-scale application of synthetic resins to cotton is a relatively new endeavor. Only in the past three years has any appreciable yardage of crease-resistant cotton been processed; and comprehensive articles on the subject include one general review (*1*) and one detailed paper in which the application of a single type of resin is studied (*5*).



A C Nuessle

Accordingly, because of the large variety of synthetic resins which are now in common use in the textile industry, we believed it worthwhile to undertake a broad study of resin types and their effect in this application. The investigation was gradually extended to include other variables, such as catalysis, mercerization, the effect of stiffeners and softeners, and fabric type.

In such a study, not only are the independent variables quite numerous; there is also an imposing number of dependent variables. For example, a single treatment may impart some degree of crease resistance, dimensional stability, and any of a variety of hand effects such as stiffness, body, or fullness. At the same time there are adverse properties, such as losses in tensile strength, tear strength, and abrasion resistance. Many of these properties can be measured by several methods, which do not necessarily correlate with each other. To keep the investigation within bounds, and to complete it within the available time, it was decided that we measure only the one desired effect — crease resistance — and a major adverse effect. Reduction in tear strength was selected as the adverse effect, because this has proved to be a very important limiting factor in the application of resins to cotton.

In our selection of test methods we were guided by the following considerations:

1) *Crease Resistance:* The term "crease resistance", to some persons, connotes a sort of springy stiffness, such that the fabric resists the pressure of the hand when lightly squeezed, and thus appears to resist the formation of a crease. To others, "crease resistance" means the ability to recover from a moderate pressure, as for example when a fabric is held in one hand, crumpled into a ball, and thrown onto the table. Finally, "crease resistance" may mean the ability to recover, to a marked degree, from an actual, rather sharp crease; a more exact name for this concept is "crease recovery". This last principle is employed in two well-known test methods: the Tootal Broadhurst Lee (*10*) and the Monsanto (*12*). In each of these, the fabric sample is creased under a given load (500 to 700 grams) for a certain length of time (5 min) then allowed to recover for another specified period (generally 3 minutes) before the reading is taken. Because of the availability of these devices, and because of their reasonable degree of

* Presented by Albert C Nuessle for the Philadelphia Sectional Committee at the 30th Annual Convention in New York on October 19, 1951.

precision, we decided to use them in the present study. While we fully recognize that they do not measure all of the subjective aspects of crease resistance, we believe that they do give a useful estimate of the degree of recovery from an actual crease; and this is an important criterion of a crease-resistant finish. Some differences between the Monsanto and TBL tests will be discussed later.

2) *Tear Strength:* At the start of the work, we employed the trapezoid tear test, which is a standard textile method (*9, 11*). Later we made use of the Elmendorf Tearing Tester (*8*), which is finding increasing use in the textile field. Here also, certain differences between methods were observed; and these will be discussed at the appropriate place. The tongue tear test on an Instron tester (7) was also employed in one experiment.

In our selection of resin types we decided to employ only standard readily available products. These may be grouped into generic types as follows:

THERMOPLASTICS——these are fully polymerized at time of manufacture, and require no catalyst or curing step. They cannot penetrate the fiber, and therefore form a film or sheath on the surface. We employed two such materials—— a polyvinyl acetate and a polyacrylate—— which were available as water dispersions or latices.

THERMOSETTING——

A) *Prepolymerized type.* This was represented by a melamine resin which had been acid-aged *(13)* to form a colloidal dispersion, which could not penetrate into the cotton fiber. While the heat of drying is generally considered sufficient to set such a resin and bond it to the surface of the fiber, we included the normal cure to insure complete fixation.

B) *Monomeric type.* There are many such products, each of which is largely diffusible into the interior of the cotton fiber, where in the presence of heat and catalyst it sets to form a resin. A certain amount of crosslinking of the cellulose chains may also occur. We selected a variety of chemical types, including urea-formaldehyde, melamine-formaldehyde, methylated melamine-formaldehyde, and ketone-aldehyde. In the early experiments we avoided, insofar as possible, products which were partially condensed so as to contain both diffusible and nondiffusible fractions. A small amount of surface resin always results, however, from condensation of monomer which either fails to penetrate, or migrates to the surface during drying.

C) *Cellulose-reactant type.* These are monomeric materials which cannot ordinarily polymerize and therefore are believed to diffuse into the fiber, where, in the presence of an acid catalyst, they appear to crosslink the cellulose chains. The possibility of a certain amount of internal resin cannot be ruled out, but no surface resin is formed from such a material. Representative types are formaldehyde itself and certain substituted urea formaldehydes. These possibilities are summarized in Table Ia.

TABLE Ia

Generic type		Specific types selected	Diffusible into fiber	Possible cross-linking	Ultimate internal resin	Location surface resin
Thermoplastic	a	Polyvinyl-acetate	no	—	—	XXX
	b	Polyacrylate	no	—	—	XXX
Polymerized Thermoset	c	Acid-aged melamine	no	—	—	XXX
Monomeric Thermoset	d	Urea-formaldehyde	yes	XX	XX	X
	e	Melamine-form	yes	XX	XX	X
	f	Methylated m-f	yes	XX	XX	X
	g	Ketone-aldehyde	yes	XX	XX	X
Reactant	h	Formaldehyde	yes	XXX	?	—
	i	Modified UF	yes	XXX	?	—

NOTE: The number of X's indicate roughly the probability of occurrence in the indicated state.

While some of the considerations are open to question, particularly as regards the relative degree of crosslinking obtained with a material which can also form a resin, it should be apparent that we have selected a rather wide variety of representative resin types.

EXPERIMENTAL

All but one of the treatments were made in the laboratory, where the conditions could be carefully controlled. In the first group of experiments, the fabrics were marked to size before treatment, and during all drying and curing operations were framed out to original dimensions so that the treated fabrics had the same thread count as the original. Several fabrics were used, each of which had been properly prepared for finishing; but as a precaution a double padding operation (two dips and two squeezes) was employed to insure uniform treatment; the wet pickup ranged from 65% to 80% according to type of fabric. The fabrics were then dried at a low temperature (below 240°F) followed by curing at an elevated temperature (generally 300°F). After a mild scour in detergent and soda ash, the fabrics were given a final drying (to size) and conditioned at least 24 hours at 65% RH and 70°F before testing.

EXPERIMENT I — RESIN TYPE

Fabric: 80 x 80 sheeting, 37½" wide, 5.20 yd/lb kier boiled, bleached, not mercerized.

Treatments: Two reactants, four resin formers, one pre-condensed thermoset, two thermoplastics as listed in Table Ia; each at several concentrations. Catalysts of type and concentration most generally employed.

Procedure: Pad (2 dips, 2 nips), bath temperature 90°F or lower.

Dry on frame to original dimensions, at 180°F.

Cure 10 minutes at 300°F.

Scour 0.1% detergent plus 0.1% soda ash, 5 min. 120°F; rinse.

Reframe to original dimensions and dry.

Condition 48 hours (70°F, 65% RH).

Determine tear strength (trapezoid method, on Scott IP4) and TBL and Monsanto crease recovery (average of warp and filling, face and back directions. Measurements taken after 3 minutes recovery time).

The results are listed in Table Ib.

To show the varied creaseproofing efficiency of the resins, crease recovery was plotted as a function of concentration (Fig 1). It is obvious that the surface resins (thermoplastic and polymerized thermosetting) are completely ineffective. Each of the diffusible resins, however, is effective, though to varying degrees. Most efficient of all, on a concentration basis, are the reactants.

This relative efficiency on a weight basis, however, is not the primary consideration. Of much greater importance is the ratio of tear strength to the improved crease recovery. This is best shown by plotting crease recovery against tear strength, as illustrated in Figure 2. For simplicity, and to level out experimental error, we plotted the average values for warp and filling tear strength,

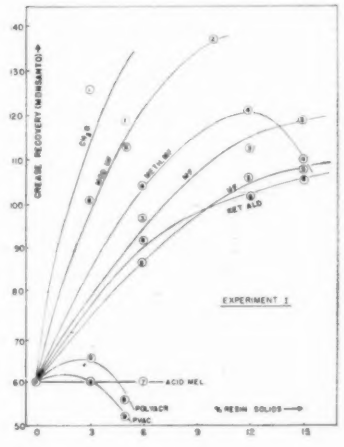


Figure 1

Creaseproofing Efficiency of Various Resins (80 x 80 sheeting)

TABLE Ib

EXPERIMENT I — EFFECT OF VARIOUS RESINS AND REACTANTS ON 80 x 80 SHEETING

% Solids applied to fabric	Treatment	Catalyst		Crease Recovery (av, W, F, f, b)		Tear Strength (Trapezoid)		
	Resin type	%	Type	Monsanto degrees	TBL units	W	F	Av
	water control	——	——	60	1.9	3.5	2.8	3.2
3	Formaldehyde	0.1	ammon chloride	126	3.5	1.2	0.9	1.1
5	Formaldehyde	0.2	ammon chloride	119	3.5	1.1	0.9	1.0
3	Reactant (Mod UF)	0.15	ammon chloride	101	3.0	1.5	1.3	1.4
5	Reactant (Mod UF)	0.25	ammon chloride	113	3.3	1.3	1.0	1.2
10	Reactant (Mod UF)	0.5	ammon chloride	137	3.5	1.2	0.9	1.1
6	Melamine-Form	0.3	organic amine HCl	97	2.9	2.0	1.7	1.9
12	Melamine-Form	0.6	organic amine HCl	113	3.3	1.8	1.4	1.6
15	Melamine-Form	0.75	organic amine HCl	119	3.3	1.8	1.3	1.5
6	Methylated Mel-Form	0.24	diammon phosphate	104	3.0	2.2	1.4	1.8
12	Methylated Mel-Form	0.48	diammon phosphate	121	3.3	1.9	1.3	1.6
15	Methylated Mel-Form	0.6	diammon phosphate	110	3.2	1.9	1.5	1.7
6	Urea-Form	0.24	diammon phosphate	87	2.6	2.2	1.9	2.1
12	Urea-Form	0.48	diammon phosphate	106	3.0	2.1	1.6	1.9
15	Urea-Form	0.6	diammon phosphate	108	3.2	1.8	1.4	1.6
6	Ketone-Aldehyde	0.6	sodium hydroxide	92	2.7	2.0	1.6	1.8
12	Ketone-Aldehyde	1.2	sodium hydroxide	102	3.0	1.8	1.4	1.6
15	Ketone-Aldehyde	1.5	sodium hydroxide	106	3.1	1.8	1.3	1.6
6	Acid-Aged Melamine	——	(acetic acid)	60	1.8	3.1	2.6	2.9
3	Polyacrylate	——	——	65	1.9	3.3	2.8	3.1
5	Polyacrylate	——	——	56	1.8	3.3	3.1	3.2
3	Polyvinyl acetate	——	——	60	1.8	3.7	3.2	3.5
5	Polyvinyl acetate	——	——	52	1.7	3.6	3.3	3.5

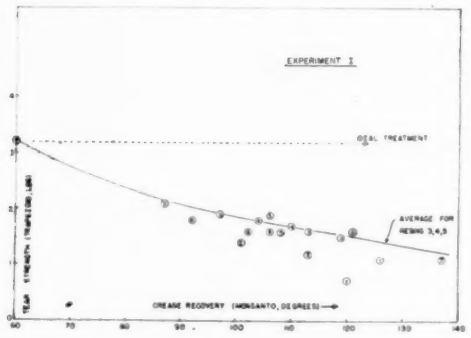


Figure 2
Reduction in Tear Strength with Improved Crease Recovery (80 x 80 sheeting)

versus warp and filling, face and back crease recovery. Only the points for the diffusible resins and reactants are plotted.

It is immediately obvious that in every case the improvement in crease recovery is accompanied by a drop in tear strength. Despite the scatter of points, it would also appear that three of the four resins fall rather closely along the same descending line. The points for the reactants are widely distributed, but in the same general direction.

EXPERIMENT II — RESIN TYPE

Fabric: 84 x 60 chambray, 39½ greige, 4.80 yd/lb, yarn dyed, mercerized.

Treatment and procedure: as before.

Table II lists the test results.

Plotting crease recovery vs concentration (Fig 3), we again note the complete ineffectiveness of the surface resins and the varied efficiencies of the resins and reactants. From the more important comparison of crease recovery vs tear strength (Fig 4) it again appears that the three resins scatter around a common descending line, while on this particular fabric the reactants quite definitely fall along a separate line to the left, or adverse direction.

It may be quite possible that a more intensive study, on a statistical basis, would show each resin and reactant to have a separate crease-recovery/tear-strength curve, which might also vary from fabric to fabric. But

TABLE II

EXPERIMENT II — EFFECT OF VARIOUS RESINS AND REACTANTS ON 84 x 60 CHAMBRAY

% Solids applied to fabric	Treatment	Catalyst		Crease Recovery (av, W, F, f, b)		Tear Strength (Trapezoid)		
	Resin type	%	Type	Monsanto degrees	TBL units	W	F	Av
	Water control	——	——	70	2.0	4.6	2.8	3.7
3	Formaldehyde	0.1	ammon chloride	113	3.2	2.2	1.4	1.8
5	Formaldehyde	0.2	ammon chloride	137	3.5	1.4	0.8	1.1
3	Reactant (Mod UF)	0.15	ammon chloride	87	2.6	3.5	2.0	2.8
5	Reactant (Mod UF)	0.25	ammon chloride	119	3.2	1.9	1.1	1.5
10	Reactant (Mod UF)	0.5	ammon chloride	137	3.5	1.7	0.9	1.3
6	Melamine-Form	0.3	organic amine HCl	108	3.1	3.1	2.1	2.6
12	Melamine-Form	0.6	organic amine HCl	124	3.4	2.8	1.8	2.3
15	Melamine-Form	0.75	organic amine HCl	126	3.4	2.7	1.5	2.1
6	Methylated Mel-Form	0.24	diammon phosphate	96	2.9	3.8	2.2	3.0
12	Methylated Mel-Form	0.48	diammon phosphate	104	3.1	3.1	1.9	2.5
15	Methylated Mel-Form	0.6	diammon phosphate	101	3.1	2.9	1.9	2.4
6	Urea-formaldehyde	0.24	diammon phosphate	90	2.7	3.5	2.3	2.9
12	Urea-formaldehyde	0.48	diammon phosphate	106	3.0	3.2	2.2	2.7
15	Urea-formaldehyde	0.6	diammon phosphate	115	3.2	3.0	1.7	2.4
6	Ketone-aldehyde	0.6	sodium hydroxide	88	2.6	3.4	2.4	2.9
12	Ketone-aldehyde	1.2	sodium hydroxide	103	3.1	2.9	1.7	2.3
15	Ketone-aldehyde	1.5	sodium hydroxide	109	3.1	2.7	1.3	2.0
6	Acid-Aged Mel	——	(acetic acid)	72	2.3	4.1	2.8	3.5
3	Polyacrylate	——	——	72	2.2	5.3	3.5	4.4
5	Polyacrylate	——	——	65	2.0	4.5	4.0	4.3
3	Polyvinyl acetate	——	——	63	2.0	4.5	2.9	3.7
5	Polyvinyl acetate	——	——	56	1.8	5.1	3.3	4.2

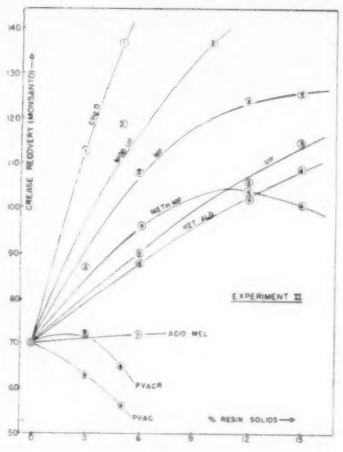


Figure 3
Creaseproofing Efficiency of Various Resins (Chambray)

from the results of these two experiments, we would conclude that in general the differences between diffusible resins——even though of widely varying chemical types ——are rather small, while reactants appear to give slightly adverse results.

TABLE III

EXPERIMENT III — EFFECT OF CATALYST TYPE

Treatment (% solids)				Tear Strength (Trap)			Crease Recovery (Monsanto)		
%	Resin type	%	Catalyst	W	F	Av	W	F	Av
4	Reactant	0.2	ammonium chloride	2.3	1.3	1.8	131	127	129
8	Reactant	0.4	ammonium chloride	2.1	1.1	1.6	136	145	141
4	Reactant	0.3	oxalic acid	2.4	1.3	1.9	120	122	121
8	Reactant	0.6	oxalic acid	2.5	1.3	1.9	132	133	133
4	Reactant	0.4	tartaric acid	3.0	1.7	2.4	107	96	102
8	Reactant	0.8	tartaric acid	2.6	1.6	2.1	123	114	119
6	UF Resin	0.05	ammonium chloride	3.5	1.9	2.7	106	114	110
12	UF Resin	0.1	ammonium chloride	2.6	1.8	2.2	136	123	130
6	UF Resin	0.25	diammon phosphate	3.2	2.1	2.7	104	97	101
12	UF Resin	0.5	diammon phosphate	3.0	1.7	2.4	118	122	120
6	UF Resin	0.3	sodium bicarbonate	3.4	2.3	2.9	92	92	92
12	UF Resin	0.6	sodium bicarbonate	2.6	1.7	2.2	116	120	118
	water control		———	4.3	3.0	3.7	76	78	77

COMPARISON OF CREASE RECOVERY TESTS——Thus far we have plotted only the Monsanto crease-recovery values. The TBL test differs from the Monsanto in one important particular: in the TBL method the test strip is hung over a wire, in the position indicated in Fig 5. Thus the fabric must recover against the force of gravity, which tends to decrease the angle (and therefore the distance d between the ends, which is the recorded value). In the Monsanto test, one end of the test strip is supported in a clamp and the other end hung in a vertical position, so that the effect of gravity is eliminated. Thus we would expect the Monsanto method to give a slightly higher value than the TBL method.

That this assumption is true is shown in Fig 6, where the TBL value for each fabric in Experiments I and II is plotted against the corresponding Monsanto value. The solid line is the theoretical correlation curve, which converts TBL readings (in centimeters) to angular recovery by means of the formula $d = 4 \sin \frac{\Theta}{2}$. If the Monsanto and

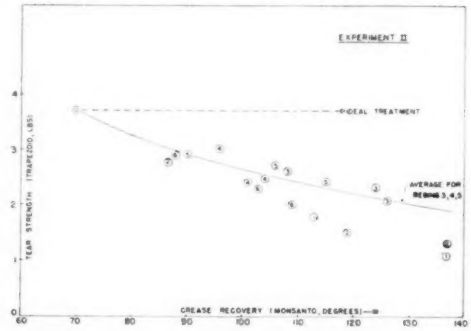


Figure 4
Reduction in Tear Strength with Improved Crease Recovery (Chambray)

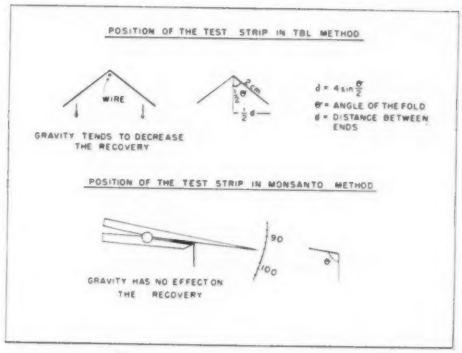

POSITION OF THE TEST STRIP IN TBL METHOD
WIRE
GRAVITY TENDS TO DECREASE THE RECOVERY
d = 4 sin Θ/2
Θ = ANGLE OF THE FOLD
d = DISTANCE BETWEEN ENDS
POSITION OF THE TEST STRIP IN MONSANTO METHOD
GRAVITY HAS NO EFFECT ON THE RECOVERY

Figure 5
Gravity Effect in Crease Recovery Tests

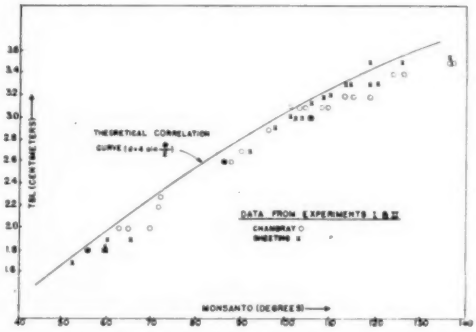


Figure 6
Relation Between TBL and Monsanto Crease Recovery

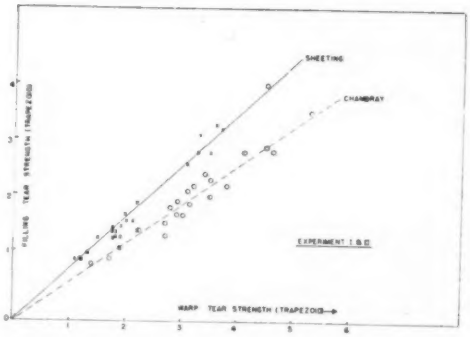


Figure 7
Showing Proportionate Reduction in Warp and Filling Tear Strength

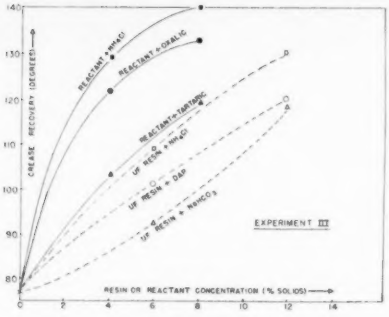


Figure 8
Efficiency of Various Catalysts

TBL tests differed only in the units in which the measurement was reported, then we would expect the values for the two tests to fall along this curve. But it is clearly seen that nearly all of the Monsanto values are slightly higher than the corresponding TBL values, as would be expected because of the elimination of the gravity effect.

Aside from this, the correlation is quite good, and we felt justified in dropping the TBL test in subsequent work, since it was giving us no new information.

COMPARISON OF WARP AND FILLING TEAR STRENGTH——Another comparison which may be made is that between warp and filling strengths. Again utilizing the data from Experiments I and II and plotting the warp versus filling strengths for each sample, we obtain two straight lines, one for each fabric (cf Fig 7). Despite the scatter of points (due largely to experimental error), it is obvious that both lines pass through the origin, indicating that in general the warp and filling strengths have been reduced proportionately by the resin treatments.

The slopes of the lines are different simply because one of the fabrics (the chambray) is more unbalanced (i e, has a considerably greater warp strength than filling strength).

CATALYST AND CURING VARIABLES——The next several experiments show the effect of type and concentration of catalyst and time and temperature of cure. One reactant and one resin former were employed in this study. A urea-formaldehyde resin was chosen since theoretically this should be quite sensitive to variations in acidity and temperature because of its low base strength. Extreme concentrations of catalyst were not used; instead, the amount of catalyst was varied over a reasonable range with consideration of the relative strengths of the various catalysts employed. All of the formulations would have a useful bath stability.

TABLE IV

EXPERIMENT IV — EFFECT OF CATALYST CONCENTRATION

Treatment				Tear Strength (Trap)			Crease Recovery (Monsanto)		
%	Type	%	Catalyst	W	F	Av	W	F	Av
8	Reactant	0.03	tartaric acid	3.0	1.8	2.4	96	95	96
8	Reactant	0.1	tartaric acid	2.5	1.5	2.0	114	114	114
8	Reactant	0.3	tartaric acid	2.3	1.2	1.8	130	121	126
8	Reactant	0.9	tartaric acid	2.3	1.4	1.9	123	118	121

EXPERIMENT III — CATALYST TYPE

Fabric: Chambray.

Treatments: a reactant, with three catalysts of varied acid strength; and a UF resin, with one alkaline and two acid catalysts.

Procedure: as before.

Results are listed in Table III.

Taking the data for the reactant and plotting crease recovery against concentration of reactant (Fig 8), we obtain three curves, one for each catalyst. It is clear that a strong catalyst will give much greater crease-proofing efficiency than a weak one. In the present instance this is true even though a greater amount of the weaker catalyst was used in each case.

A similar result is obtained when the data for the UF resin are plotted (Fig 8). The peculiar shape of the curve for the $NaHCO_3$ catalyst is typical; probably this catalyst should be employed at a fixed concentration on total bath rather than on total resin.

The fact that an alkaline catalyst works at all is of considerable academic interest. Since formaldehyde and other reactants cannot be cured in this way, it is very doubtful whether any crosslinking of the cellulose occurs. Further, it is possible that only a linear polymer (instead of a three-dimensional one) is formed. Yet considerable crease resistance is obtained.

If we now plot crease recovery vs tear strength, we again obtain typical descending curves (Fig 9). Despite the considerable differences in catalyst strength, there is comparatively little difference in the tear strength of the treated fabrics at a given level of crease recovery. There is, further, no evidence of acid degradation due to the use of the ammonium-chloride catalyst; such degradation would have caused severe strength loss without further improvement in crease recovery.

EXPERIMENT IV — CATALYST CONCENTRATION

Fabric: Chambray.

Treatment: Fixed concentration of reactant, varied amounts of tartaric acid catalyst.

Procedure: as before.

The data are listed in Table IV.

Plotting (Fig 10), we find that crease recovery improves rapidly with catalyst concentration, but levels off beyond 0.3%. (In the present case there is a slight reversal with increased concentration, which may in part be experimental error and in part an indication that the excess catalyst is combining with the reactant and thus reducing its efficiency.)

Plotting crease recovery against tear strength, however, we again obtain the typical descending line shown in Fig 11. Included in the plot are the data for tartaric acid from the previous experiment (where the amount of reactant was varied with the

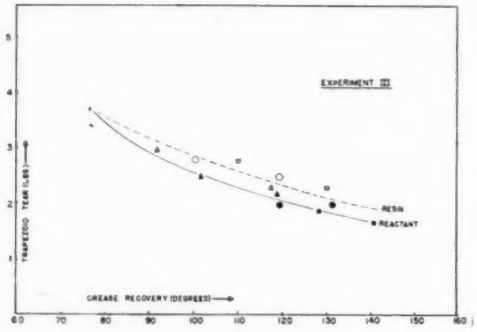


Figure 9
Effect of Catalyst Type

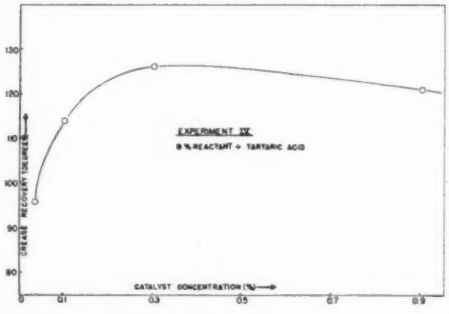


Figure 10
Effect of Catalyst Concentration on Crease Recovery

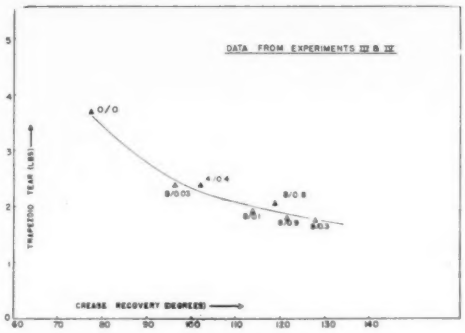


Figure 11
Effect of Catalyst Concentration on Crease Recovery Recovery and Tear Strength

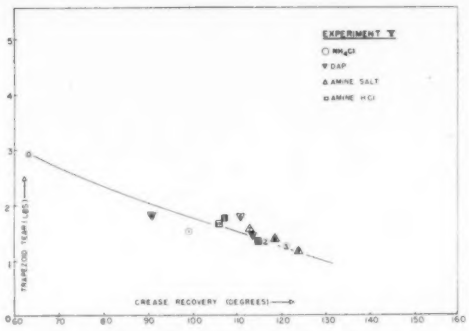


Figure 12
Effect of Catalyst Type and Concentration

catalyst in proportion). Although the two experiments were run independently, the agreement is good; and it is apparent that, while there is an optimum concentration of catalyst insofar as maximum creaseproofing efficiency is concerned, it is not likely that superior crease recovery with maintained tear strength will result from the use of a particular concentration of catalyst.

EXPERIMENT V — CATALYST TYPE AND CONCENTRATION

Fabric: 80 x 80 sheeting.

Treatment: Urea-formaldehyde resin, with two ammonium-salt and two organic-amine-salt catalysts. Two concentrations of resin were used with the catalyst both at constant concentration and at constant ratio to resin. Resin concentration is expressed in % solids, while catalyst is % product. Here again the selected range of catalyst concentration was in each case a normal one, which would give good curing and reasonable bath stability.

Data are shown in Table V and plotted in Figure 12.

There is a considerable scatter of points, part of which may be due to experimental error; but the following generalizations can be drawn:

The advantage of the amine-type catalysts, if there be one, seems to come at the lower resin concentration, where the points for the regular catalysts fall below the curve. At the higher resin concentration, no advantage is evident.

The effect of increased catalyst concentration, in three cases out of four, is to raise the crease recovery and lower the tear; the resulting points all lie on or close to the curve, so that the net effect is increased efficiency of the resin rather than a better crease-recovery/tear ratio.

Therefore, while only a few combinations were tried, we would conclude that no great advantage in improved crease-recovery/tear-strength ratio is likely to ensue from the use of a particular concentration of a particular catalyst.

TABLE V

EXPERIMENT V — EFFECT OF CATALYST TYPE AND CONCENTRATION

Treatment				Tear Strength			Crease Recovery		
%	Resin Type	%	Catalyst	W	F	Av	W	F	Av
	Control		———	3.1	2.9	3.0	68	59	63
7	UF	0.1	ammonium chloride	1.8	1.4	1.6	103	95	99
15	UF	0.1	ammonium chloride	1.6	1.2	1.4	117	117	117
15	UF	0.2	ammonium chloride	1.5	1.0	1.3	119	122	121
7	UF	0.3	diammon phosphate	2.0	1.5	1.8	92	90	91
15	UF	0.3	diammon phosphate	1.7	1.2	1.5	112	115	114
15	UF	0.6	diammon phosphate	2.0	1.6	1.8	110	112	111
7	UF	0.7	complex amine salt	1.7	1.4	1.6	113	113	113
15	UF	0.7	complex amine salt	1.5	1.2	1.4	115	119	117
15	UF	1.4	complex amine salt	1.4	1.0	1.2	126	122	124
7	UF	0.7	amine hydrochloride	2.0	1.4	1.7	108	103	106
15	UF	0.7	amine hydrochloride	2.1	1.4	1.8	110	103	107
15	UF	1.4	amine hydrochloride	1.7	1.1	1.4	117	112	115

EXPERIMENT VI — CURING CONDITIONS

Fabric: Chambray.

Treatment: A single concentration of resin and catalyst (15% UF, 0.6% DAP) cured over the range 10 to 40 minutes at 280°, and 5 to 20 minutes at 325°F.

Procedure: as before, with exception of curing conditions. Tear strength was determined only in the warp direction.

The data are listed in Table VI and graphed in Figure 13.

There is a spread of points on either side of the line, but no trend is apparent and we conclude that curing conditions, over the range studied, have little influence on the tear strength at equivalent crease recovery.

From a summary of the evidence obtained in this brief study of catalysis and curing conditions, it does not appear that any major improvement in the crease-recovery/tear-strength ratio can be obtained through the use of a certain set of conditions. We should not assume, however, that catalysts and curing conditions are unimportant variables since, through overcatalysis or overcure or a combination of both, it is possible to obtain cellulose degradation, which would give values inferior to those here reported.

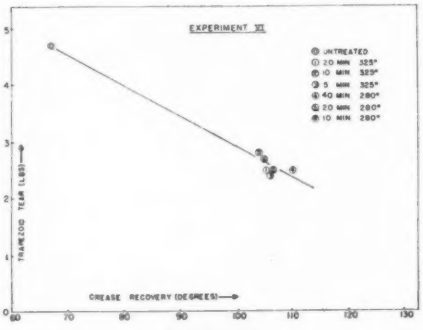


Figure 13
Effect of Curing Conditions

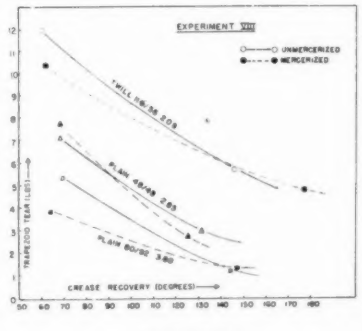


Figure 14
Effect of Pre-mercerization

TABLE VI

EXPERIMENT VI — EFFECT OF CURING CONDITIONS

Treatment: 15% UF resin plus 0.6% DAP

Cure		Tear (Trap)	Crease Recovery (degrees)
Time (min)	Temp (°F)	(Warp)	(Av, W, F, b, f)
20	325	2.5	106
10	325	2.8	104
5	325	2.4	106
40	280	2.5	110
20	280	2.5	106
10	280	2.7	105
Untreated control		4.7	67

TABLE VII

EXPERIMENT VII — WEAR TEST

	Monsanto Crease Recovery			Elmendorf Tear Strength		
	W	F	Av	W	F	Av
Untreated	65	85	75	3.8	2.4	3.1
Untreated, laundered	72	83	78	—	—	—
Resin-treated	119	129	124	1.8	1.2	1.5
Resin-treated, laundered	113	126	120	—	—	—

TABLE VIII

EXPERIMENT VIII — EFFECT OF PREMERCERIZATION

		Tear (Trapezoid) (warp)		Crease Recovery (warp)	
Fabric	Treatment (% solids)	Unmerc	Merc	Unmerc	Merc
Twill 118/56	water control	12.0	10.4	60	62
	5% reactant 0.25% NH_4Cl	5.8	4.7	146	177*
Plain 48/48	water control	7.2	7.8	68	68
	5% reactant 0.25% NH_4Cl	3.0	2.8	132	125
Plain 80/92	water control	5.5	4.0	69	63
	5% reactant 0.25% NH_4Cl	1.3	1.4	144	147

* This value is obviously too high, possibly the result of an error in recording. From other work with this fabric, not here reported, we would expect this value to be only slightly higher than that of the corresponding unmercerized.

ACTUAL USE TEST——Although the purpose of the present study was to determine the relative importance of the many variables affecting crease recovery and tear strength, it was felt that some correlation to actual use would be worth demonstrating. We are therefore including the following brief study, contributed by a member who had run a small pilot-plant trial employing a finish on which only laboratory data had previously been available.

EXPERIMENT VII — WEAR TEST

Fabric: Broadcloth.

Treatment: 13% UF resin, 0.65% sodium bicarbonate catalyst, 0.05% penetrating agent in bath; applied at 65% wet pickup.

Procedure: Padded, dried and cured in one operation, 30 minutes in loop drier at roughly 300°F. This fabric, along with portions of the original, was then made into skirts to be given use tests.

Table VII summarizes the properties of the original fabric, the treated, and both fabrics after full sanforize wash (40 minutes at 200°F, followed by 20 minutes rinsing in washwheel).

It is apparent that the expected improvement in crease recovery and the usual lowering of tear strength were obtained; and that the treatment is resistant to laundering.

To test the significance of the crease-recovery values, two skirts were fabricated, each made half of treated and half of untreated broadcloth. The skirts were worn by test subjects as they went about the normal routine of their laboratory work and received no special attention except that the dresses were hung up carefully each night and donned the following morning without pressing. The fabrics were light in color (taupe #124) without stripes or other figures to confuse the eye; thus the slightest wrinkles were easily discerned.

The skirts were examined daily over four-day wearing periods. In every case the creases in the untreated panels were sharper, exactly as would be anticipated from the measured recovery values. Far more important, however, from the standpoint of maintaining neat appearance in a garment, is the fact that the small wrinkles that gave the untreated panels a mussed, untidy look were almost completely absent from the treated panels. These observations were true for both laundered and unlaundered skirts, again as would be expected from the test values. The wearers also reported that they felt at all times that the treated panels of their skirts were acceptably neat.

This brief experiment indicates that the laboratory crease-recovery test has significance in the actual end use. It must not be concluded, however, that a recovery of 120° will be necessary in every case; lesser degrees of recovery may be acceptable, depending on the fabric type and more particularly on the color or print pattern and the intended end use. Since acceptability is a very subjective property, it was not studied further in the present investigation.

MERCERIZATION——The early anti-crease process for linen called for pre- and aftermercerization, the purpose of the latter being to help overcome the excess embrittlement produced by resin treatment. In the next several experiments the effects of pre- and aftermercerization, individually and together, were studied. Three sets of fabrics were employed, representing mercerized and corresponding unmercerized. These fabrics, which varied widely in construction, had been mercerized by the three mills that contributed them.

EXPERIMENT VIII — PREMERCERIZATION

Fabric: a) Twill 118 x 56, 2.08 yd/lb, 40½" wide. b) Plain 48 x 48, 2.85 yd/lb, 35½" wide. c) Plain 80 x 92, 3.80 yd/lb, 34½".

Treatment: In this preliminary experiment, a single treatment was employed: 5% Reactant (applied solids) plus 0.25% NH_4Cl catalyst.

Procedure: padded twice, dried to original dimensions at 200°F, cured 5 minutes at 300°F. Scoured, dried, conditioned, tested. Tear strength and crease recovery were determined in warp direction only, but the crease was made both face in and back in as before, and the average reported.

The data are shown in Table VIII and plotted in Fig 14.

Three distinctions are readily observed:

The biggest difference is that due to fabric construction. The twill (the heaviest fabric) was the strongest to begin with and remained strongest after resin treatment, whether mercerized or not. Likewise, the plain 80/92 (the lightest fabric) was weakest throughout.

Mercerization appeared to have the greatest difference on the original fabric (i e, before resin treatment). In two cases out of three, the mercerization lowered the original tear strength. On subsequent resin treatment the differences leveled out, so that there was no marked advantage or disadvantage in premercerization.

We have no explanation for the peculiar tendency for the curves of the mercerized and unmercerized fabrics to cross each other. We did not examine this further, but proceeded with the following study of premercerization as it affected subsequent treatment with a variety of resins.

EXPERIMENT IX — PREMERCERIZATION

Fabric: Plain weave 48/48, mercerized

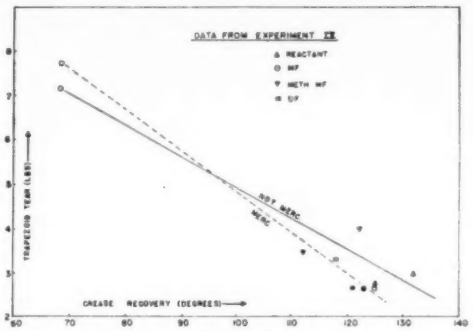


Figure 15
Effect of Pre-mercerization

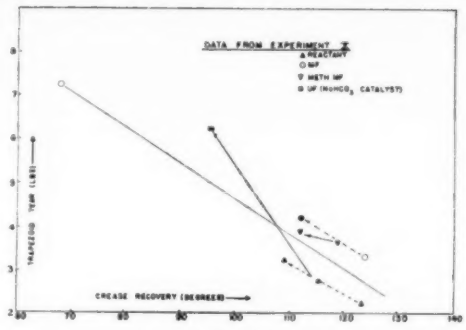


Figure 16
Effect of After-mercerization

and unmercerized, as employed in preceding study.

Treatment: Melamine, methylated melamine, and urea resins.

Procedure: as before.

Table IX lists the data, together with the values for the reactant from the preceding experiment.

Plotting (Fig 15) and comparing with the previous figure, we see that in general the effect of mercerization on this particular fabric is the same for the resin formers as it was for the reactant.

EXPERIMENT X — AFTERMERCERIZATION

Fabric: Plain weave 48x48, unmercerized.

Treatment: one reactant, three resin formers.

Procedure: fabric padded, dried, cured as before; then, while held out on a pin frame, mercerized thoroughly in cold 25% NaOH (15 minutes at room temperature), rinsed well, neutralized quickly with cold 1% acetic acid, rinsed, dried.

The data are listed in Table X and plotted in Figure 16.

The effect of aftermercerization at constant dimensions seems to be to increase the strength at the expense of crease recovery, resulting in a regression back along the crease-recovery/tear curve.

The treatment which deviated rather sharply in direction and length of displacement was the alkaline-catalyzed urea-formaldehyde. Probably because of the absence of chemical crosslinking, this treatment swelled more than the others in the mercerizing caustic, and tore loose from the pin frame at several points, so that the fabric shrank slightly. This is no doubt the main reason for the disproportionate gain in strength.

A number of supplementary experiments were conducted in an attempt to determine the effect of shrinkage during mercerization, but the procedure was difficult to control and widely variable results were obtained. We could only conclude that, if the fabric was not allowed to shrink, the regression was generally back along the same CR/tear curve. The best results were obtained when the fabric was held out but tore loose from the frame during mercerization thus allowing shrinkage but under considerable tension. This occurred most readily with the alkaline-cured urea resin, as indicated above.

In certain instances, not always coinciding with a good CR/tear value, the alkaline-cured urea exhibited another distinguishing feature: the mercerized fabric on occasion had a translucent luster and a slight crispness. This could not be obtained with any of the acid-catalyzed treatments. It may have value as a finish.

Because of the difficulties involved in obtaining reproducible results, and also because aftermercerization as a means of restoring strength to resin treatments is well known (though perhaps not completely understood), we did not explore this procedure further, beyond the one final experiment reported below.

EXPERIMENT XI — PRE- AND AFTERMERCERIZATION

Fabric: Plain weave 48 x 48, mercerized.

Treatment: One reactant, three resin formers (including both acid- and alkaline-catalyzed urea-formaldehyde).

Procedure: as in preceding experiment.

The data are listed in Table XI, and plotted in Figure 17.

Here again the fabric treated with alkaline-catalyzed urea resin tore loose from the frame and thus deviated widely from the original CR/tear curve. Two of the treatments (the methylated melamine and the reactant) regressed approximately as before; while the methylated melamine and the acid-catalyzed urea (which did not tear loose from the frame) showed anomalous behavior. For reasons given earlier, however, we did not spend further time on mercerization but proceeded next with a study of the effect of additives, such as stiffening and softening agents.

STIFFENING AND SOFTENING AGENTS——A stiffening agent is a polymeric material which cannot penetrate the fibers, but which does penetrate the yarns and cements the fibers together; it also bonds the yarns at the crossover points. Thus the fabric is less flexible. A softener similarly

TABLE IX

EXPERIMENT IX — EFFECT OF PREMERCERIZATION

Fabric: Plain weave 48 x 48 (merc and unmerc)

Treatment		*Tear (Trap) (warp)*		*Crease Recovery (degrees warp)*	
% Resin Solids	*% Catalyst*	*Unmerc*	*Merc*	*Unmerc*	*Merc*
12% MF	0.6 amine HCl	2.7	2.7	125	123
12% Meth MF	0.5 DAP	4.0	3.5	122	112
15% UF	0.5 $NaHCO_3$	3.3	2.7	118	121
5% Reactant	0.25 NH_4Cl	3.0	2.8	132	125
Control		7.2	7.8	68	68

TABLE X

EXPERIMENT X — EFFECT OF AFTERMERCERIZATION

Fabric: Plain weave 48 x 48 (not mercerized)

Treatment		*Tear (Trap) (warp)*		*Crease Recovery (degrees warp)*	
% Resin Solids	*% Catalyst*	*Unmerc*	*Merc*	*Unmerc*	*Merc*
12 MF	0.6 amine HCl	3.3	4.3	124	112
12 Meth MF	0.5 DAP	3.7	3.9	119	112
15 UF	0.5 $NaHCO_3$	2.8	6.3	115	95
5 Reactant	0.25 NH_4Cl	2.3	3.3	124	109
Control		7.2	—	68	—

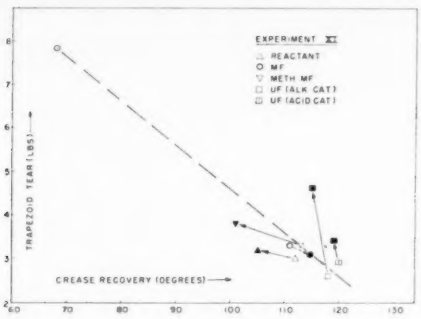


Figure 17
Effect of Pre- and After-Mercerization

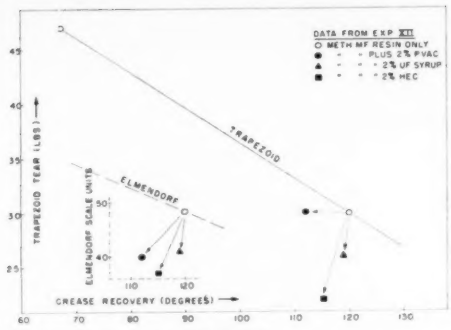


Figure 18
Effect of Stiffening Agents (Chambray)

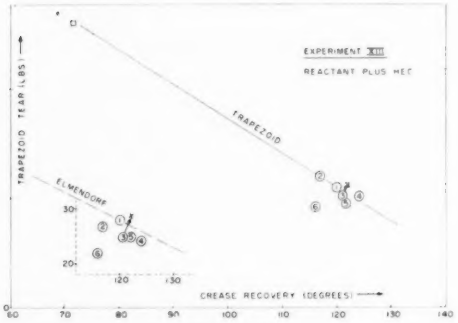


Figure 19
Effect of Increasing Amounts of Stiffener

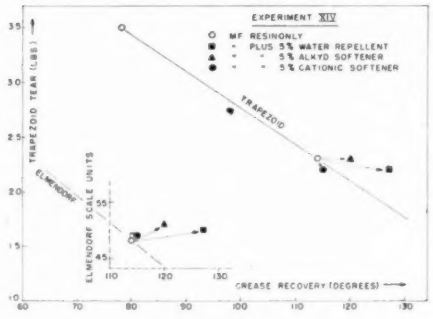


Figure 20
Effect of Various Softeners (Chambray)

goes on the surface, but since it is a waxy or oily material, it lubricates the fibers and yarns and makes the fabric more flexible.

In the next several experiments, we examined the effect of such materials on the crease recovery and tear strength of resin-treated cotton fabric.

EXPERIMENT XII — STIFFENING AGENTS

Fabric: Chambray.

Treatment: one concentration of resin and catalyst, three stiffening agents. The latter included a thermoplastic (polyvinylacetate dispersion), a partially polymerized thermosetting resin (UF syrup), and a water soluble polymer (hydroxyethylcellulose).

Procedure: the stiffening agents were predissolved and added to aliquot portions of the resin/catalyst bath at 90°F. Application to fabric was made as before, including the afterscour.

Tear strength was determined not only by the trapezoid test (with the Scott IP4) as in earlier experiments, but also by the Elmendorf test (with the Elmendorf Tearing Tester).

The data are listed in Table XII and plotted in Figure 18.

All three stiffeners had a slightly adverse effect: the polyvinylacetate reduced the crease recovery without greatly affecting the tear strength, while the other materials more generally reduced the tear strength. The hydroxyethylcellulose, which had the greatest adverse effect, also gave the greatest degree of stiffness.

The effect of stiffening agents on this particular fabric is not very pronounced, but there appears to be a definite trend. The agreement between the two types of tear test is generally good.

EXPERIMENT XIII — CONCENTRATION OF STIFFENING AGENT

Fabric: 80 x 80 sheeting.

Treatment: a reactant was selected, since this yields no surface resin of its own. A single concentration of reactant and catalyst was selected, with varied amounts of water-soluble hydroxyethylcellulose (HEC). In one case a softener was included to determine the combined effect of stiffening agents and softener.

Procedure: as in preceding experiment.

TABLE XI

EXPERIMENT XI — EFFECT OF BOTH PRE- AND AFTERMERCERIZATION

Fabric: Plain weave 48 x 48 (mercerized).

Treatment		*Tear (Trap) (warp)*		*Crease Recovery (degrees warp)*	
% Resin Solids	*% Catalyst*	*Unmerc**	*Merc**	*Unmerc*	*Merc*
12 MF	0.6 amine HCl	3.3	3.1	111	115
12 Meth MF	0.5 DAP	3.3	3.8	113	101
15 UF	0.5 $NaHCO_3$	2.6	4.6	118	115
15 UF	0.1 NH_4Cl	2.9	3.4	120	119
5 Reactant	0.25 NH_4Cl	3.0	3.2	112	105
Control		7.8	—	68	—

* Both fabrics were premercerized; these headings show whether aftermercerized.

TABLE XII

EXPERIMENT XII — EFFECT OF STIFFENING AGENTS

Treatment (Solids Basis)	*Crease Recovery*			*Tear Strength*	
12% Meth MF plus 0.6% DAP plus	*W*	*F*	*Av*	*Trap W*	*Elmendorf* W*
No stiffener	121	119	120	3.0	48
2% Polyvinylacetate	114	110	112	3.0	40
2% UF Syrup	119	119	119	2.6	41
2% Hydroxyethylcellulose	117	112	115	2.2	39
water control (no resin)	68	65	67	4.7	70

* Elmendorf scale units, 2″ test strip.

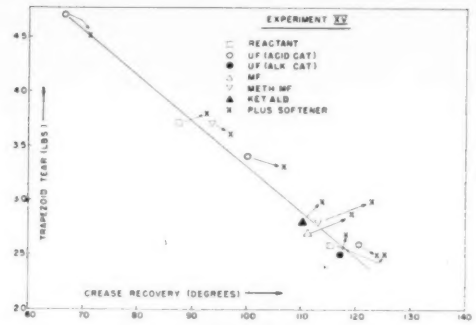


Figure 21
Effect of Softener (Trapezoid data)

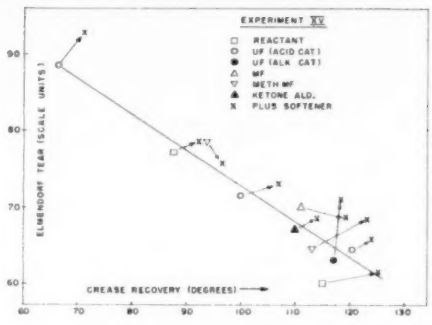


Figure 22
Effect of Softener (Elmendorf data)

There was no danger that the afterscour would remove the HEC since this is insolubilized by the reactant.

The data are listed in Table XIII and plotted in Figure 19.

It is evident that a little surface material may be tolerated; only at the highest concentration was there a definite adverse effect. The Elmendorf test appears to be the more sensitive in showing the effect, but the difference is small; part of the scatter of points results from normal experimental error.

In the one instance where softener was added, the trend was reversed; here again the Elmendorf appeared to be the more sensitive test.

EXPERIMENT XIV — SOFTENERS

Fabric: Chambray.

Treatment: one concentration of melamine resin and catalyst with a single concentration of three softeners: (a) a durable water repellent, known also for its excellent softening effect; (b) an emulsion of a soft alkyd resin; and (c) a cationic softener.

Procedure: as before.

The data are listed in Table XIV and plotted in Figure 20.

Here there appears to be a trend in the desired direction, but the magnitude is small. Moreover, the cationic softener, which has excellent lubricating properties, seems completely ineffective.

In order to determine more precisely whether the indicated trend was a real one, we proceeded to the next study, in which a single softener was used in conjunction with a wide variety of resin treatments.

EXPERIMENT XV — SOFTENER

Fabric: Chambray.

TABLE XIII

EXPERIMENT XIII — EFFECT OF VARIED CONCENTRATION OF STIFFENING AGENT

Treatment	*Crease Recovery*	*Tear Strength*	
		Trap	*Elmen**
5% Reactant plus 0.25 NH_4Cl plus	*Av*	*Av*	*Av*
0.0 Hydroxyethylcellulose	120	1.1	28
0.1 Hydroxyethylcellulose	117	1.2	27
0.3 Hydroxyethylcellulose	121	1.0	25
0.7 Hydroxyethylcellulose	124	1.0	24
1.5 Hydroxyethylcellulose	121	1.0	25
4.0 Hydroxyethylcellulose	116	0.9	22
0.3 HEC plus 1% alkyd softener	122	1.1	29
Water control (no reactant)	72	2.6	51

* Elmendorf scale units, 2½″ test strip.

TABLE XIV

EXPERIMENT XIV — THE EFFECT OF SOFTENERS

*Treatment**	*Crease Recovery*			*Tear Strength*	
				Trap	*Elmen***
10% MF plus 0.5% Amine HCl plus	*W*	*F*	*Av*	*Av*	*W*
No softener	108	120	114	2.3	48
5% Durable water repellent	127	126	127	2.2	50
5% Alkyd emulsion	117	123	120	2.3	51
5% Cationic softener	114	115	115	2.2	49
Water control (no resin)	76	80	78	3.5	77

* Softener Conc is % product; balance % solids.

** Elmendorf scale units, 2″ strip.

TABLE XV

EXPERIMENT XV — EFFECT OF SOFTENER

Softener: 1% of an alkyd dispersion, applied to wet fabric after the scour.

Treatment					*Crease Recovery*			*Tear Strength*	
								Trap	*Elmen**
%	*Resin Type*	*%*	*Catalyst*	*Softener*	*W*	*F*	*Av*	*W*	*W*
	Water control			—	68	65	67	4.7	89
	Water control			X	68	74	71	4.5	93
3	Reactant	0.15	NH_4Cl	—	81	94	88	3.7	77
3	Reactant	0.15	NH_4Cl	X	90	95	93	3.8	78
6	Reactant	0.3	NH_4Cl	—	112	119	116	2.6	60
6	Reactant	0.3	NH_4Cl	X	122	128	125	2.5	62
6	Meth MF	0.3	DAP	—	86	101	94	3.7	78
6	Meth MF	0.3	DAP	X	92	101	97	3.6	76
12	Meth MF	0.6	DAP	—	113	113	113	2.8	64
12	Meth MF	0.6	DAP	X	124	122	123	3.0	69
7	Urea-F	0.05	NH_4Cl	—	101	99	100	3.4	71
7	Urea-F	0.05	NH_4Cl	X	106	108	107	3.3	74
15	Urea-F	0.10	NH_4Cl	—	119	122	121	2.6	64
15	Urea-F	0.10	NH_4Cl	X	122	126	124	2.5	66
15	Urea-F	0.6	$NaHCO_3$	—	115	119	117	2.5	63
15	Urea-F	0.6	$NaHCO_3$	X	115	121	118	2.7	71
12	Melamine-F	0.6	amine HCl	—	111	111	111	2.7	70
12	Melamine-F	0.6	amone HCl	X	117	121	119	2.8	68
15	Ketone-Ald	1.0	NaOH	—	105	115	110	2.8	67
15	Ketone-Ald	1.0	NaOH	X	110	118	114	3.0	68

* 2½-inch test strip.

TABLE XVIa

EXPERIMENT XVI—EFFECT OF SOFTENER ON VARIOUS FABRICS

Treatment[1] % Product		MUSLIN						BROADCLOTH						JEAN					
		Warp		Filling		Average		Warp		Filling		Average		Warp		Filling		Average	
Reactant	Softener	CR[2]	Tear[3]	CR	Tear	CR	Tear	CR	Tear	CR	Tear	CR	Tear	CR	Tear	CR	Tear	CR	Tear
15	—	140	444	143	218	142	331	130	541	139	376	135	459	119	950	133	595	126	773
15	5	149	519	152	285	151	402	137	762	147	407	142	585	129	1405	144	890	137	1148
12.5	—	130	421	136	207	133	314	129	551	134	389	132	470	113	1042	132	605	123	824
12.5	5	148	536	145	310	147	423	134	744	143	402	139	573	122	1548	139	838	131	1193
10	—	129	439	131	231	130	335	123	528	130	372	127	450	104	950	129	720	117	835
10	5	137	602	137	310	137	456	128	776	132	448	130	612	114	1786	132	941	123	1364
7.5	—	124	451	121	250	123	351	110	565	119	423	115	494	101	1015	119	784	110	900
7.5	5	134	621	129	347	132	484	122	861	128	490	125	676	108	1772	121	1012	115	1392
5	—	115	405	112	285	114	345	104	603	109	452	107	528	90	1245	101	794	96	1020
5	5	126	624	122	347	124	486	109	1018	114	613	112	816	93	1958	110	1205	102	1582
Water control		67	838	77	605	72	722	66	1015	80	720	73	866	66	1762	72	1100	69	1431

NOTES: [1] Included tartaric acid catalyst, 4% on reactant product. 1% sodium-acetate buffer added with durable water repellent (WR#1) used as softener.

[2] Monsanto crease recovery, degrees.

[3] Elmendorf scale units x 32, to convert to grams. Sufficient replicates were run to give some significance to the third figure.

Treatment: one reactant and four resins; some at two concentrations, and one with two different catalysts. The softener was the same alkyd emulsion employed in the previous experiment.

Procedure: The resin applications were made as in earlier experiments, to and including the afterscour. The softener was then applied to half of each sample as a final rinse. All samples were then framed out to size, dried, conditioned, and tested.

The results are shown in Table XV and plotted in Figures 21 and 22.

The trapezoid and Elmendorf data are plotted separately with the circles in each showing the original values and the x's showing the values after softening. There is a definite trend in the desired direction (to the right of the curve). Crease recovery is improved in every case, although the effect on tear strength is rather erratic.

The two tear tests show good agreement in the way in which they rank the treatments. The Elmendorf, however, seems slightly more affected by the softener, since eight of the tear values show increased strength; in comparison, only five of the ten trapezoid values show an increase.

This experiment also afforded a brief comparison of the effect of resin type; the earlier findings were substantially confirmed, except that the reactant appears in a more favorable light.

SOFTENERS ON OTHER FABRICS—— Most of the work reported this far had been carried out on two fabrics: an 80-square sheeting and a chambray. In the meantime studies on other fabrics were being made in another laboratory; the emphasis was on the effect of softeners, but valuable information was also obtained on mercerization and on the effect of resin type. These experiments will be reported next.

EXPERIMENT XVI — SOFTENER AND FABRIC TYPE

Fabrics: Muslin 84 x 78, 2.9 oz/sq yd, bleached, not mercerized; Broadcloth 142 x 62, 3.3 oz/sq yd, bleached, mercerized; Jean 83 x 50, 6.1 oz/sq yd, bleached, mercerized; Poplin 112 x 50, 4.9 oz/sq yd, bleached (there is some doubt, however, as to whether this fabric was mercerized).

Treatment: Each fabric was treated with several concentrations of a reactant and with tartaric acid as the catalyst. The treatments were then repeated with the addition of 5% (product) of a durable water repellent (Code WR#1) plus 1% sodium-acetate buffer.

Procedure: Padded at room temperature. Air dried, then cured 3 min at 325°F. Scoured 5 minutes at 120°F in 0.05% detergent plus 0.1% soda ash. Rinsed, pressed dry, conditioned, tested. The fabrics containing the water repellent were rebaked 3 minutes at 325°F after being scoured.

In this series of experiments the fabrics were not framed to size, but handled slack throughout. It is not believed, however, that any significant change in dimensions resulted; in one case where a thread count was made, the original counted 111 x 50, the reactant-treated was 109 x 50, and the reactant/softener was 109 x 51. However, the slack treatment may account, to some extent, for the greater magnitude of some of the effects to be reported.

Monsanto crease recovery and Elmendorf tear tests were made on all fabrics; for comparison, the trapezoid tear test (on Scott X-3) was made on the poplin only.

The data are listed in Tables XVIa and XVIb.

Plotting crease recovery vs Elmendorf tear strength for the four fabrics, we obtain the family of curves shown in Figure 23. Here two conclusions are immediately apparent: a) Comparing the curves for the reactant only (solid lines) it is obvious that the stronger fabrics, after resin treatment, are those which were stronger originally; b) the addition of softener has a beneficial effect on both crease recovery and Elmendorf tear strength, but the magnitude of the increased tear strength is a function of fabric type. Referring now to Figure 24, where the Elmendorf and trapezoid data for the poplin are compared, we see that the latter shows a much smaller effect due to addition of softener.

Another important difference between the two tear tests is the fact that the warp and filling strengths of the poplin are reduced

TABLE XVIb

EXPERIMENT XVI—EFFECT OF SOFTENER ON POPLIN FABRIC

(Reactant Finish)

Treatment % Product		Crease Recovery degrees			Elmendorf Tear grams			Trapezoid Tear lb		
Reactant	Softener	Warp	Fill	Av	Warp	Fill	Av	Warp	Fill	Av
15	—	126	131	129	707	502	605	3.8	2.2	3.00
15	5	139	145	142	966	666	816	3.9	2.2	3.05
12.5	—	119	125	122	672	538	605	3.8	2.3	3.05
12.5	5	137	139	138	995	685	840	4.1	2.3	3.20
10	—	116	120	118	749	496	623	4.0	2.6	3.30
10	5	127	133	130	1178	752	965	4.4	2.7	3.55
7.5	—	108	117	113	730	586	658	4.1	2.9	3.50
7.5	5	123	129	126	1178	829	1004	4.8	3.3	4.05
5	—	97	103	100	810	630	720	4.4	2.9	3.65
5	5	109	116	113	1299	989	1144	5.1	3.3	4.20
Water control		65	78	72	1082	1008	1045	7.6	4.9	6.25

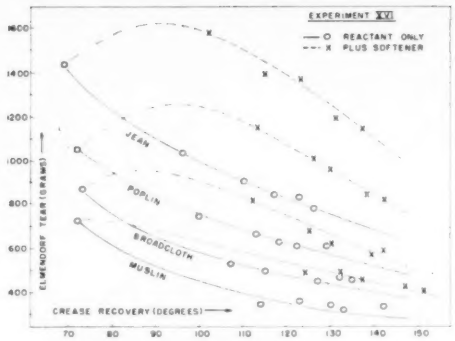


Figure 23
Effect of Softener on Various Fabrics)

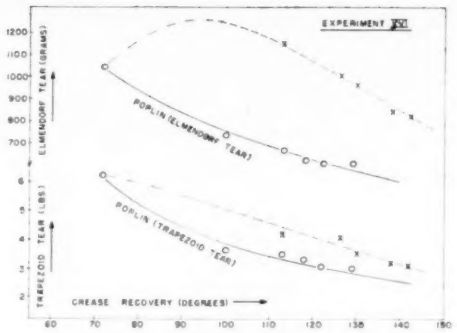


Figure 24
Effect of Softener on Tear Strength (Poplin)

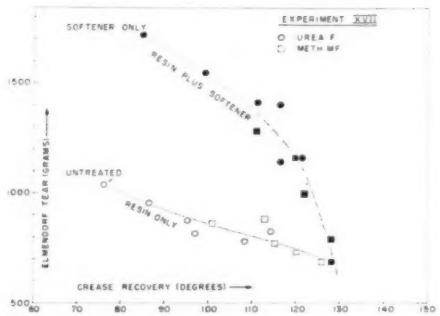


Figure 25
Effect of Two Resins and Softener on Poplin (Elmendorf data)

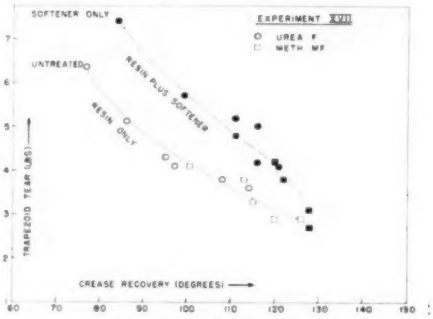


Figure 26
Effect of Two Resins and Softener on Poplin (Trapezoid data)

proportionately as shown by the trapezoid test, whereas the filling strength is more rapidly reduced as measured by the Elmendorf test. Thus it appears that the Elmendorf test is more sensitive to fabric construction.

It should be pointed out that the Elmendorf values for these particular fabrics, treated and tested by the procedures outlined, are decidedly lower than the corresponding trapezoid values (this is true in each case, although complete data are given for only one fabric). Thus the effect of softener is not to give the fabric a superior ripping strength, but merely to enhance a rather deficient one. In the case of the chambray (Exp XV) the Elmendorf tear was fully as great as the trapezoid, and the addition of softener had a more moderate effect.

To show that the present effect is not limited to reactant treatments, the next experiment employed two resin formers.

EXPERIMENT XVII — SOFTENER AND RESIN TYPE

Fabric: Poplin, as in previous experiment.

Treatment: Urea formaldehyde and methylated melamine resin-formers, using the usual 3.5% (on resin solids) of ammonium phosphate catalyst. The softener (Code WR#2) was a slightly different durable water repellent than that used previously; 1% sodium acetate buffer was included with this material.

Procedure: as in preceding experiment.

Refer to Table XVII and Figures 25 and 26.

It is apparent that the softener has again shown a pronounced effect on the Elmendorf tear but only a slight effect on the trapezoid. The melamine resin imparts higher crease recoveries than the urea (this is exaggerated somewhat by the fact that the products were not employed at equal solids) but the points fall along a common crease-recovery/tear curve.

The effect of the softener falls off at higher resin concentration and eventually becomes negligible. This is no doubt due to the increasing stiffness caused by surface resin. Such an occurrence is not seen in the case of the reactant finish (Fig 24) where no surface resin is formed.

Attention was then turned to the comparative effect of premercerization and softening as means of obtaining enhanced results.

TABLE XVII

EXPERIMENT XVII—EFFECT OF SOFTENER ON POPLIN FABRIC (RESIN FINISH)

Treatment % Product Resin	Softener*	UF Resin Crease Recovery Av Deg	UF Resin Elmen Tear Av g	UF Resin Trap Tear Av lb	Meth MF Resin Crease Recovery Av Deg	Meth MF Resin Elmen Tear Av g	Meth MF Resin Trap Tear Av lb
20	—	114	821	3.6	126	684	2.9
20	2	121	1159	4.1	128	677	2.7
15	—	108	776	3.8	120	732	2.9
15	2	116	1136	4.2	128	786	3.1
10	—	97	816	4.1	115	767	3.3
10	2	116	1395	5.0	122	990	3.8
7.5	—	95	874	4.3	113	879	3.8
7.5	2	111	1408	5.2	120	1158	4.2
5	—	86	954	5.1	101	855	4.1
5	2	99	1548	5.7	111	1276	4.8
Water control		76	1034	6.4			
—	2	84	1716	7.4			

* Durable water repellent (WR#2)

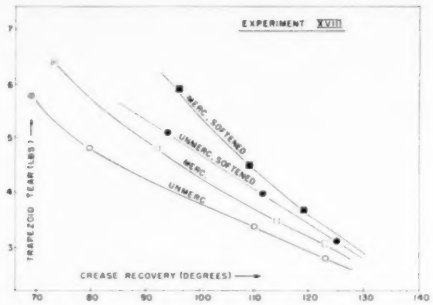


Figure 27
Comparative Effect of Mercerization and Softening (Trapezoid data)

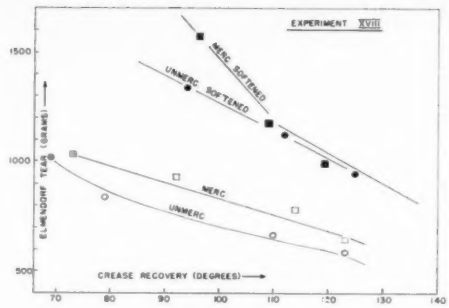


Figure 28
Comparative Effect of Mercerization and Softening (Elmendorf data)

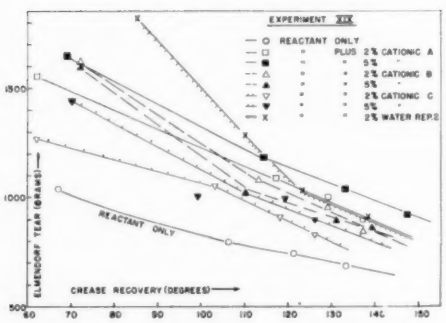


Figure 29
Effect of Various Softeners on a Reactant Finish

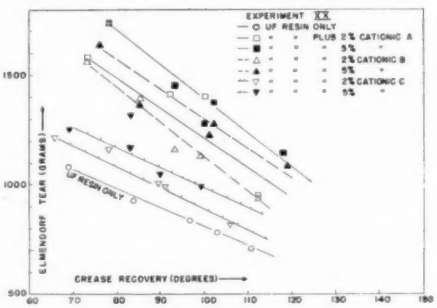


Figure 30
Effect of Cationic Softeners on a UF Resin Finish

TABLE XVIII

EXPERIMENT XVIII—COMPARATIVE EFFECT OF PREMERCERIZATION VS SOFTENING

Fabric: 112 x 50 Poplin

Treatment % Product		Not mercerized			Mercerized		
Reactant	Softener*	Crease Recovery Av Deg	Elmen Tear Av g	Trap Tear Av lb	Crease Recovery Av	Elmen Tear Av	Trap Tear Av
5	—	79	837	4.8	92	923	4.8
5	5	94	1338	5.1	96	1562	5.9
10	—	110	666	3.4	114	783	3.5
10	5	112	1126	4.0	109	1163	4.5
15	—	123	592	2.8	123	642	3.1
15	5	125	943	3.1	119	994	3.7
Water control		69	1021	5.8	73	1027	6.4

* Durable water repellent (WR#1)

TABLE XIX

EXPERIMENT XIX—RELATIVE EFFICIENCY OF DIFFERENT SOFTENERS (Reactant Finish)

% Product		Type of Softener Cationic A		Cationic B		Cationic C		Water Rep #2	
Reactant	Softener	Crease Recovery Av deg	Elmen Tear Av g	Crease Recovery Av deg	Elmen Tear Av g	Crease Recovery Av deg	Elmen Tear Av g	Crease Recovery Av deg	Elmen Tear Av g
—	2	62	1554	72	1620	62	1267	85	1821
—	5	69	1645	72	1594	70	1440		
5	2	117	1086	113	1077	103	1046	110	1285
10	2	129	1002	129	952	118	903	123	1023
15	2	137	898	137	843	126	823	138	909
5	5	114	1181	110	1019	99	1035		
10	5	133	1039	131	895	119	994		
15	5	147	918	139	860	126	898		
5	—	106	791						
10	—	121	741						
15	—	133	687						
Water control		67	1033						

EXPERIMENT XVIII —

PREMERCERIZATION VS SOFTENING

Fabric: Poplin.

Treatment: Reactant, with a fixed concentration (0.6%) of tartaric-acid catalyst; durable water repellent (WR#1), with 1% sodium-acetate buffer.

Procedure: a portion of the fabric was given a thorough mercerization in the laboratory, then treated along with some of the original fabric.

Table XVIII lists the data.

Plotting the Trapezoid values (Fig 27) we see that mercerization shows a slight beneficial shift in the curve, softening shows a greater one, and the effects are additive. By the Elmendorf test (Figure 28) mercerization also has a slight effect, but again the effect of softener is quite pronounced on this particular fabric.

It has by this time become evident that the Elmendorf test is responding more to fabric construction and to treatments (e g, with stiffeners and softeners) which modify the yarn and fabric interrelationships, than it is to factors such as mercerization or choice of resin or reactant type, which result in changes inside the fiber.

The value of this present experiment is negated to a certain extent by the fact that the exact history of the fabric is not known; it may have already received a plant mercerization. If so, it is believed to have been

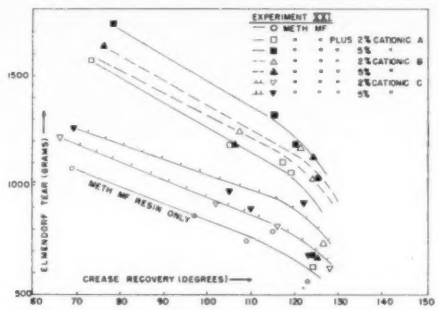


Figure 31
Effect of Cationic Softeners on a Meth. MF Finish

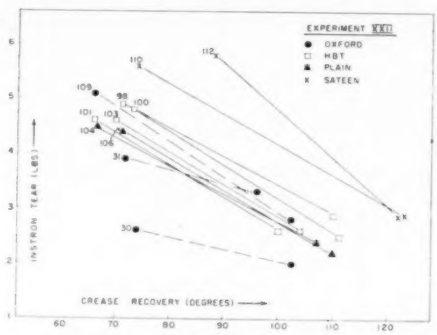


Figure 32
Effect of Fabric Construction (Instron data)

a very ineffectual one.

The last three experiments in this series show the comparative efficiencies of various softeners on several reactant and resin finishes; the data may also be used to compare the resins with the reactant.

EXPERIMENT XIX — EFFICIENCY OF SOFTENERS

Fabric: Poplin.

Treatment: Reactant, 0.6% tartaric acid catalyst; three cationic softeners; one durable water repellent (WR#2), plus 1% sodium acetate buffer.

Procedure: as in previous experiment.

Refer to Table XIX and Figure 29. There are obvious differences in the abilities of the softeners to increase the strength and crease recovery of either the treated or untreated fabric. Cationic B, which shows considerable effectiveness here, is the same softener that proved ineffectual on the chambray in Experiment XIV. No reason for this can be assigned.

EXPERIMENT XX — SOFTENERS WITH UF RESIN

Fabric: Poplin.

Treatment: UF resin, 0.6% buffered acid catalyst; three cationic softeners as above.

Procedure: as above.

Refer to Table XX and Figure 30.

The softeners exhibit the same relative efficiency as in the preceding experiment.

EXPERIMENT XXI — SOFTENERS WITH METH MF RESIN

Fabric: Poplin.

Treatment: Meth MF resin, 3.5% (on resin solids) DAP catalyst, three softeners as above.

Procedure: As above.

See Table XXI and Figure 31.

The softeners again show varied efficiencies. Of considerable importance is the fact that at high concentration there is a dip in each curve, due presumably to a buildup of surface resin, as noted in Experiment XVII.

From a comparison of Figures 29, 30, and 31 it would appear that, on this fabric at crease recoveries below 110°, the reactant and two resins fall closely along a common crease-recovery/tear curve.

EFFECT OF FABRIC CONSTRUCTION ——In the experiments reported thus far, the greatest factor in obtaining high crease recovery with high tear strength has been choice of fabric. While those experiments were being concluded, a brief but extensive study of the effect of fabric construction was in progress elsewhere. In this experiment, sixteen fabrics ranging from 5.7 oz per sq yd to 21.4 oz/sq yd were treated with a single concentration of resin. By plotting the points for the untreated and treated fabrics, a rough idea of the relative slopes of the crease-recovery/tear strength curves could be obtained. This study is reported next.

EXPERIMENT XXII — FABRIC CONSTRUCTION

Fabrics: Refer to Table XXIIa.

Treatment: 15% solids MF resin, 0.75% amine HCl catalyst in bath. No softener was

TABLE XX

EXPERIMENT XX—EFFICIENCY OF SOFTENERS (UF-RESIN FINISH)

% Product		Cationic A		Cationic B		Cationic C	
Resin	Softener	Crease Recovery Av deg	Elmen Tear Av g	Crease Recovery Av deg	Elmen Tear Av g	Crease Recovery Av deg	Elmen Tear Av g
—	2	73	1563	73	1560	66	1210
—	5	78	1731	76	1633	69	1255
5	2	92	1407	85	1389	78	1158
7.5	2	100	1399	94	1154	91	986
10	2	89*	1113	99	1123	89	991
20	2	112	944	112	946	106	810
5	5	93	1442	85	1368	83	1311
7.5	5	102	1370	102	1274	83	1165
10	5	100	1276	101	1216	90	1047
20	5	118	1138	119	1082	99	983
5	—	84	922				
7.5	—	97	832				
10	—	103	781				
20	—	111	702				
Water control		69	1072				

* Anomalous value, which was not further checked.

TABLE XXI

EXPERIMENT XXI—EFFICIENCY OF SOFTENERS (METH MF FINISH)

% Product		Cationic A		Cationic B		Cationic C	
Resin	Softener	Crease Recovery Av deg	Elmen Tear Av g	Crease Recovery Av deg	Elmen Tear Av g	Crease Recovery Av deg	Elmen Tear Av g
5	2	105	1180	107	1240	102	912
7.5	2	117	1098	121	1161	74*	1147*
10	2	119	1055	124	1029	116	805
20	2	124	629	127	730	128	621
5	5	115	1319	106	1179	105	970
7.5	5	120	1182	124	1120	110	899
10	5	82*	1359*	125	1030	122	919
20	5	124	673	125	660	123	680
5	—	97	860				
7.5	—	109	743				
10	—	115	786				
20	—	123	552				

* Anomalous value, which was not further checked.

used. Wet pickup varied widely, but no adjustment was made in the bath since it was not necessary to have equal solids on each fabric.

Procedure: Fabrics thoroughly desized and scoured, dried; padded twice, dried at 200°F, and cured 10 min at 300°F. Scoured and redried. During each drying operation the fabrics were framed out as close to original dimensions as possible. Where processing shrinkage was unavoidable, care was taken that the untreated and treated portions of each sample had the same final dimensions. Tests included Monsanto crease recovery and Elmendorf and tongue tear (the latter on the Instron tester).

The results are listed in Table XXIIb, and data for eleven of the fabrics are plotted in Figures 32 and 33.

It will be observed that the crease-recovery/tear curves for seven of the fabrics (four herringbone twills, one oxford, and two plain weaves) are essentially parallel; this indicates that the ratio of strength loss to improvement in crease recovery is the same in each case. Sateen 110 shows comparatively small strength loss by the Elmendorf test but not by the Instron, and sateen 112 shows a rather high strength loss by both tests. Most interesting are the oxfords 30 and 31. These have a desirable flat curve (indicating small strength loss) by both tear tests.

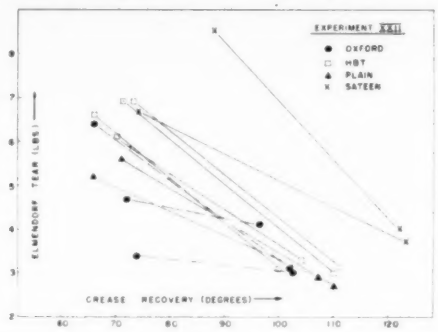


Figure 33
Effect of Fabric Construction
(Elmendorf data)

TABLE XXIIa

Code	Weave	Weight oz/sq yd	Count W	Count F	Yarn Number W	Yarn Number F	K1	K2	B	Crimp % W	Crimp % F	Thickness in
22	Oxford	5.7	190	95	76/2	76/2	30.9	15.4	1.00	17.6	2.8	.017
23	Oxford	7.1	156	77	76/3	76/3	31.0	15.3	1.00	14.8	3.2	.021
25	Oxford	10.4	113	54	38/3	38/3	31.5	15.2	1.00	18.3	4.2	.027
11	Oxford	21.4	55	24	9/3	9/3	31.7	13.6	1.00	23.1	4.4	.048
30	Oxford	6.5	188	69	76/2	41/2	30.5	15.2	1.36	18.3	1.9	.019
31	Oxford	7.9	153	54	76/3	38/3	30.4	15.2	1.41	20.7	1.6	.021
33	Oxford	11.8	110	39	38/3	19/3	30.8	15.5	1.41	18.0	1.2	.029
98	HBTwill	10.6	82	64	12.8/1	10.3/1	22.9	20.0	1.12	20.9	10.6	.027
100	HBTwill	9.9	81	54	12.8/1	10.3/1	22.7	16.8	1.12	19.8	10.0	.027
101	Mod HBT	10.6	82	63	12.8/1	10.3/1	22.9	19.7	1.12	19.6	12.7	.031
103	Mod HBT	10.1	82	55	12.8/1	10.3/1	22.9	17.2	1.12	22.0	13.2	.029
104	Plain	9.2	82	52	12.8/1	10.3/1	22.9	16.2	1.12	22.4	9.7	.0235
106	Plain	8.9	79	45	12.8/1	10.3/1	22.1	14.0	1.12	23.4	8.2	.026
109	Oxford	9.0	85	43	12.8/1	10.3/1	23.8	13.4	1.12	12.3	15.3	.0265
110	Sateen	11.2	84	71	12.8/1	10.3/1	23.5	22.2	1.12	17.7	13.9	.036
112	Sateen	10.5	85	61	12.8/1	10.3/1	23.8	19.0	1.12	16.9	15.6	.037

Notes: K^1 = warp cover factor (ratio of threads per inch to sq root of yarn number)
K^2 = filling cover factor
B = sq root of ratio of warp to filling yarn number.

TABLE XXIIb

EXPERIMENT XXII—EFFECT OF FABRIC CONSTRUCTION

Sample	Instron Tear (lb) W	Instron Tear (lb) F	Instron Tear (lb) Av	Elmendorf Tear (lb) W	Elmendorf Tear (lb) F	Elmendorf Tear (lb) Av	Crease Recovery (degrees) W	Crease Recovery (degrees) F	Crease Recovery (degrees) Av
Untreated									
22	TF	1.7	—	3.1	1.8	2.5	59	64	62
23	TF	2.1	—	4.3	2.8	3.6	70	73	72
25	TF	4.1	—	12.6	6.1	9.4	60	53	57
11	TF	15.0	—	TF	25.0	—	81	94	88
30	2.5	2.7	2.6	3.0	3.7	3.4	74	73	74
31	3.6	4.1	3.9	4.6	4.7	4.7	74	70	72
33	6.0	7.2	6.6	12.5	12.2	12.3	67	71	69
98	4.4	5.4	4.9	6.3	7.4	6.9	63	79	71
100	4.6	5.0	4.8	6.5	7.2	6.9	60	85	73
101	4.0	5.1	4.6	6.4	6.8	6.6	58	73	66
103	4.4	4.8	4.6	6.4	5.7	6.1	61	78	70
104	4.0	4.9	4.5	5.2	5.2	5.2	65	67	66
106	3.9	4.8	4.4	5.8	5.3	5.6	65	77	71
109	6.0	4.2	5.1	7.1	5.7	6.4	61	71	66
110	5.6	5.6	5.6	7.9	5.5	6.7	83	64	74
112	5.9	5.7	5.8	8.6	8.4	8.5	72	104	88
Treated									
22	TF	1.9	—	TF	1.7	—	107	105	106
23	TF	1.9	—	TF	2.0	—	109	90	100
25	TF	4.1	—	TF	3.8	—	100	84	92
11	TF	15.1	—	TF	16.4	—	90	106	98
30	1.9	2.1	2.0	2.9	3.1	3.0	109	95	102
31	3.2	3.4	3.3	4.0	4.2	4.1	105	87	96
33	5.2	6.2	5.7	5.5	5.4	5.5	100	94	97
98	2.5	3.2	2.9	2.8	3.1	3.0	101	119	110
100	2.5	2.5	2.5	3.1	3.1	3.1	120	102	111
101	2.5	2.6	2.6	3.0	3.2	3.1	100	100	100
103	2.6	2.6	2.6	3.3	3.2	3.3	97	110	104
104	2.3	2.4	2.4	2.8	3.0	2.9	106	107	107
106	1.9	2.4	2.2	2.5	2.8	2.7	110	110	110
109	3.1	2.5	2.8	3.3	2.8	3.1	97	106	102
110	3.2	2.6	2.9	3.7	3.7	3.7	108	137	123
112	3.1	2.6	2.9	4.3	3.6	4.0	119	124	122

Note: TF indicates sample tore in filling during warp tear test.

On the average, the eleven fabrics showed an increase in recovery from 72° to 108° as the result of resin treatment; and had an accompanying tear-strength loss of 43% by Instron (tongue tear) and 46% by Elmendorf. By comparison, if the two oxfords were to undergo this same improvement in recovery, they would be expected to lose an average of only 17% by Instron and 28% Elmendorf.

Not plotted are four oxfords on which complete data could not be obtained because of a tendency to tear in the filling during a warp tear test; the filling data, however, show low strength losses by the Instron test and low to average losses by the Elmendorf test. A fifth oxford (no. 33) which was not plotted also showed little strength loss on the Instron, but rather high strength loss on the Elmendorf.

It is apparent that fabric construction, including yarn type as well as weave, plays an important part in determining the extent of tear loss on resin treatment. It is also apparent that the type of tear test must be specified, since the various fabric constructions respond in different ways to different types of tearing force. Preliminary attempts to relate the various parameters of fabric construction listed in Table XXIIa to the slopes of the crease-recovery/tear-strength curves have not been very successful; but it is felt that further investigation along this line would be exceedingly worthwhile.

One factor that deserves special mention since it is not apparent in the table is float length. In the case of the warp sateens 110 and 112, which had a float length of four, there was a marked face and back effect: a

crease in the warp direction, with the face of the fabric turned in, had a low recovery value; but when the fabric was creased face out, a high value was obtained. In the filling direction, the face and back effect was reversed. These differences persisted after the fabric was resin-treated. The magnitude of this effect is shown in Table XXIIc.

It will be observed that crease recovery in the minimal directions was no greater, after treatment, than it was in the other directions before treatment.

TABLE XXIIc
FACE AND BACK EFFECTS
IN A WARP SATEEN

	Untreated		*Treated*	
	Warp	*Fill*	*Warp*	*Fill*
Face out	103°	78°	128°	99°
Face in	70°	101°	103°	123°

GENERAL CONCLUSIONS

In this study of the improved crease recovery of cotton fabrics through the use of synthetic resins, we have examined the effect of resin type, catalysts, curing conditions, mercerization, stiffening and softening, and fabric type. In brief, we have shown that the crease recovery of cotton fabrics may be greatly enhanced by treatment with any one of a variety of resin-formers and reactants. Improved recovery is always accompanied by a loss in tear strength; and in order to obtain a high crease-recovery value with maximum tear strength, it is necessary to select a suitable fabric and to include a softener in the treatment. Surface resins not only fail to produce crease recovery, but, if present in too large amounts, detract from the crease recovery imparted by internal resin. Catalysts and curing conditions do not appear to be critical. Premercerization has relatively slight effect. Over-all, the most important variable appears to be choice of fabric.

Earlier we pointed out several possible aspects of crease resistance. We have now shown that tear strength is also a more complex property than has previously been recognized.

In the sections below we shall elaborate on each of these topics.

SPECIFIC CONCLUSIONS——

1) *Effect of Resin Type.*

(a) Surface resins do not impart crease recovery (cf Expt I and II).

(b) Reactants are more efficient on a concentration basis than are resin formers (cf I, II, III).

(c) Resins and reactants improve crease recovery only at the expense of tear strength (all experiments).

(d) In most cases the loss in tear strength is greater at the start, ie, the tear loss accompanying a gain of 30° in crease recovery may be two-thirds that resulting from a gain of 60° (cf I, II, XVI).

(e) The resin formers appear to give greater tear strength at equal crease recovery than do the reactants (cf I, II), but on certain fabrics the effect seems about equal (compare XVI and XVII; XIX, XX, XXI).

2) *Effect of Catalyst and Curing Conditions.*

(a) Stronger catalysts give greater efficiency from a given concentration of resin (cf III).

(b) No great improvement in the crease-recovery/tear-strength ratio is likely to result from the use of a certain concentration of a certain catalyst (cf III, IV, V).

(c) Curing conditions, over the range studied, do not appear to be critical (cf VI).

3) *Effect of Mercerization.*

(a) Premercerization has a relatively slight effect, which in general is a beneficial one (cf VIII, IX, XVIII).

(b) Aftermercerization reduces both crease recovery and tear strength to roughly a proportionate extent if the fabric is not allowed to shrink (cf X, XI).

(c) If during mercerization the fabric is allowed to shrink under tension, an improvement in the crease-recovery/tear-strength ratio may result (cf X, XI).

4) *Effect of Stiffening and Softening Agents.*

(a) Stiffening agents tend to reduce either tear strength or crease recovery, or both (cf XII), but a small amount of stiffener can sometimes be tolerated (cf XIII).

(b) Softeners tend to improve both crease recovery and tear strength, but the degree of improvement varies widely with fabric construction and with the type of tearing force (cf XV, XVI).

(c) Different softeners vary in the degree to which they improve crease recovery and tear strength (cf XIV).

5) *Effect of Fabric Construction.*

(a) The stronger fabrics generally, but not always, remain stronger after resin treatment (cf VI, XVI, XXII).

(b) The improvement obtainable through the addition of softener varies widely with fabric type (cf XV, XVI).

(c) Measured by the trapezoid test, warp and filling tear-strength losses are roughly proportionate; but, measured by the Elmendorf test, strength losses may be quite disproportionate, depending on fabric type (cf I, II, XVI).

REMARKS

THE MEANING OF CREASE RESISTANCE—The following remarks are intended to indicate the place of crease recovery in the broader concept of crease resistance.

We have shown that crease recovery, as measured several minutes after the creasing load has been removed, may be markedly improved by treatment with resin-formers or reactants. We have also shown that delayed recovery, or the ability of a creased garment to smooth out on hanging up overnight, is related to the more rapid three-minute recovery (cf Expt VII). But we have not investigated the more subjective (though nevertheless important) property of instantaneous recovery, which reflects itself in a springy handle; nor have we measured the resistance to a bending force, which is identical with fabric stiffness. We have, however, shown that fabric stiffness tends to preclude good crease recovery.

In the latter connection, it has often been observed that many persons, on flexing two fabrics, one of which has excellent crease recovery but a soft handle and the other a poorer crease recovery but stiffer handle, will select the latter as being more "crease-resistant". We suggest that the stiffer fabric will make a better blouse (for example) since such a garment is not subjected to intense creasing forces but must have sufficient crispness to hold its shape; that is why blouses are frequently starched. But the softer fabric will make a better skirt, since the important property in such a use is the ability to recover from the sharp creases incurred during such normal activities as sitting down.

THE MEANING OF TEAR STRENGTH—Another ambiguity which was uncovered during the course of this investigation is the difference between the trapezoid and Elmendorf tear tests.

Applied to a series of resin treatments on a given fabric, the two test methods give proportionate results, although they do not agree as to actual value. When a softener is added, however, the Elmendorf may give disproportionately higher results on certain fabrics (compare Fig 24). Since a softener increases the tear strength by allowing the yarns to slide into closer contact so that they can reinforce each other, we conclude that the Elmendorf test is more sensitive to changes in fabric construction.

The question of which test is more meaningful is a difficult one to answer. In the trapezoid test, a load is slowly applied until the fabric tears; the tear strength thus obtained is a limiting value below which the fabric will not fail. In the Elmendorf, a load greater than that which the fabric can bear is suddenly applied; the tear strength thus obtained is a measure of the work done in tearing the sample. As a crude analogy, we might say that the trapezoid value is useful in predicting whether the trousers of a stout gentleman will part at the seams when he slowly bends over; whereas the Elmendorf value is useful in predicting the length of the rip which would be produced if he were to snag the same trousers on a barbed-wire fence.

There is no doubt that further study of the Elmendorf Tearing Test would be very revealing, particularly in regard to the cor-

relation with other tearing tests on softened cotton fabrics; and we strongly recommend that such a study be made.

CLOSING COMMENTS—As we come to the close of our study, it would be foolish indeed to claim that we have solved all the problems involved in improving the crease recovery of cotton. Further work remains to be done on many aspects of the subject, and we have attempted to indicate those places where confusion still exists in terminology (eg the meaning of "tear strength," "crease recovery," and "crease resistance") and the places where work seems most likely to be of immediate value (eg fabric design, and the effect of additives, such as softeners, which modify the yarn and fabric interrelationships).

It was inevitable that we would in some instances merely confirm previously held opinions; but in many particulars we believe that our findings are new. In either case, sufficient evidence has been gathered to enable us to present a broad picture of the subject, with the important landmarks clearly defined, and the lesser ones in proper perspective.

It is hoped that the study, which for the most part was extensive rather than intensive, will dispel some of the mystery and misunderstanding surrounding the creaseproofing of cotton, will serve as a guide for those intending to process cotton fabrics with synthetic resins, and will indicate the paths along which further investigation is likely to be worthwhile.

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Meeting Report— BDTI Student Chapter

February 26, 1952
Bradford Durfee Technical Institute,
Fall River, Mass

ON FEBRUARY 26, 1952, the Bradford Durfee Technical Institute Student Chapter held its meeting and lecture in the school library.

Richard H Lewis, chief chemist for the Providence Dyeing, Bleaching & Calendering Company, was the guest speaker. His topic, "The Importance of Chemical Control in Textile Dyeing and Finishing", covered the methods used in controlling water analysis, desizing, bleaching, mercerizing, dyeing, and finishing of textile goods.

Respectfully submitted,
EDWARD W MAKUCH, *Secretary*

LAPEL BUTTONS FOR MEMBERS

These buttons bear the seal of the AATCC and may be purchased by members in good standing from the National Secretary at $2.00 each.

DR HAROLD C CHAPIN
Lowell Textile Institute
Lowell, Massachusetts

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Wool Oil——

(Concluded from Page 192)

a definite asset. For example, roping may be left on the frames or jacks over the weekend and still start up with a minimum of trouble on Monday morning.

The ability of an oil to control static is also important in spinning and also influences Monday morning starts.

FINISHING——After the wool oil has served its purpose in carding and spinning, it must be removed. It is equally important that the wool oil be easily removed in fulling and scouring; otherwise smelly goods, stains, streaks, and uneven dyeing can result. The oil should not thin the fulling soap excessively, as this will lead to slow, often uneven fulling, chafe marks, excessive flocking and mediocre cloth.

Grease goods should be storable without discoloring or creating odors. This calls for a wool oil with good aging characteristics, i e, resistance to oxidation. In the past, many wool oils have gotten by when the goods were put through quickly. However, under today's conditions where grease goods are frequently stored for long periods while awaiting dye orders, these oils would cause all kinds of trouble in finishing and dyeing. In this connection, considerable work has been done by a committee of the AATCC in developing a laboratory test method for evaluating the aging or keeping characteristics of wool oils. Completeness of oil removal is very important on piece dyes to assure level dyeing.

CONCLUSIONS

In selecting a wool oil, one must consider the overall picture. This means that the wool oil must 1) lubricate the fibers during carding and hold fiber breakage to a minimum, 2) control static and keep fly and waste down, 3) assist in rubbing and hold the rub in the roping, and 4) assure a uniform draw and twist insertion in spinning.

It certainly is an advantage to the carder to have a wool oil that is self-emulsifiable. It should give stable emulsions which do not break on contact with the wool, thereby avoiding uneven roping weights, possible "heating in the bin" and bacterial action, due to the accumulation of moisture at the bottom of the bin.

Good spreading properties are desirable in a wool oil in order to insure uniform results.

The ability of a wool oil to retain moisture is very important since it can affect roping weights, fly, and carding and spinning efficiency, as well as the buildup of static. It also increases spinning efficiency and makes it possible to start up after a weekend shutdown with a minimum of trouble.

The oil should show a minimum shrinkage or loss in carding, thus aiding in better control of the roping weights and more efficient use of the oil. Card waste would also be less likely to be loaded with oil, and yields would be better.

The ideal wool oil should have good antistatic properties. This is particularly important when blends are run which contain the newer fibers that are so susceptible to static buildup.

The aging or keeping qualities of an oil are particularly important in connection with fulling, scouring, and dyeing. Naturally, good resistance to oxidation is a must today when goods often have to be stored in the grease for lack of dye orders.

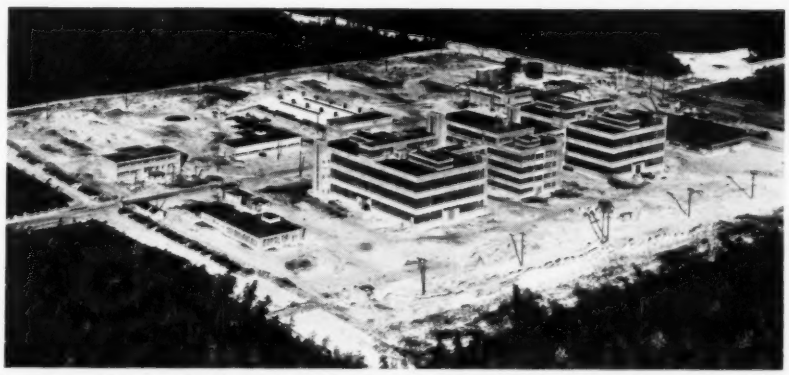
Lastly, the ideal oil should allow easy scouring, be completely removable, and aid in consistently producing level piece dyes at low cost.

NEWS

• Ciba Expects Completion of N J Plant Before Year's End

Ciba Company's vast new plant at Toms River, New Jersey, for which ground was first broken in the Spring of 1949, is rapidly nearing completion on a 1200-acre tract in central New Jersey. Confronted with repeated delays in construction almost from the beginning because of the Korean War, Ciba gradually has overcome the ensuing critical shortages in essential structural material and new equipment, allowing a completion date to be set for 1952. The new plant is entirely "Ciba" in conception, design, engineering, equipment and ownership and reportedly will be operated exclusively by Ciba upon completion.

Because of the accessible location (Toms River being close to and from both New York and Philadelphia areas via the new New Jersey Turnpike), expanded dyestuffs research and technical service facilities will be important adjuncts to the production operations.



A recent photograph shows the advanced stage of construction of the new Ciba Company plant in Toms River, N J. The official plant dedication is tentatively scheduled for October.

Philip Kronowitt, Ciba's Chief Engineer at Toms River, who has directed the entire project ever since the blueprint stage, sums up the status of operations as follows:

"The accelerated progress of recent months is due entirely to the expediting of many of the materials and equipment essential to our plans and because we have kept all other phases of work moving as rapidly as possible. This has enabled us to overcome a considerable amount of the lost time that originally set our time table back almost nine months. It is now possible, in light of recent progress, for us to inform the industries who will benefit from the resources of Ciba's new vat dyes plant that we should be in the position to initiate production at the Ciba Toms River plant before the end of the year."

Louis C Barail

• Dr Barail Sets Up Consultant Service

Dr Louis C Barail, who was associated with the United States Testing Co for the past eleven years, is now available to industry as a Consultant Biochemist and Toxicologist at 222 West 83rd Street, New York 24, N Y (TRafalgar 7-1504) and in Hackensack, N J (HUbbard 7-0053).

He is specializing in development, promotion, research, sanitation and toxicology in the fields of Biologicals, Cosmetics, Disinfectants, Food Products, Packaging Materials, Pesticides, Pharmaceuticals and Plastics.

• Useful Life of Tobacco Shade Cloth Reported Tripled by New Process

The service life of cotton cloth used to shade seed beds and growing tobacco plants can be at least tripled by a process developed by the Southern Regional Research Laboratory, Bureau of Agricultural and Industrial Chemistry, New Orleans, La, according to the U S Department of Agriculture. The development was illustrated by samples of the treated cloth in a recent exhibit at the annual meeting of the National Cotton Council in New Orleans.

Pieces of test cotton fabrics prepared by this process and used to cover tobacco fields in North Florida during the past three seasons reportedly still had two to three times as much of their original strength left as did ordinary tobacco shade cloth after only one season's use.

The weather-resistant finish responsible for this increased life consists of lead-chromate, an inorganic yellow pigment, which screens out the damaging rays of sunlight. The basic principles developed by SRRL for applying this treatment to shade cloth reportedly have proved to be commercially feasible, and the chemically processed fabric is now available for a slight increase in cost over the untreated cloth.

• Naugatuck Expands on West Coast

A major expansion of facilities for the manufacture and sale of rubber latex and plastic materials on the West Coast, has been undertaken by Naugatuck Chemical Division, United States Rubber Company.

A new plant has been completed on Telegraph Road, Los Angeles, Cal, which will be the division's western sales headquarters. The plant reportedly will contain customer technical service laboratories, facilities for the compounding and storage of natural and synthetic rubber latex, and facilities for warehousing resins, plasticizers, rubber chemicals, agricultural chemicals and other products in the Naugatuck Chemical Line.

Naugatuck Chemical first set up a plant on the West Coast in 1946.

• AVC Textile Research Dept Adds New Equipment

Among the latest equipment to be installed at American Viscose Corporation's Textile Research Department in Marcus Hook, Pa, is a Fielden Moisture Recorder. New Proctor and Schwartz web and batt forming equipment has also been added.

The moisture recorder is an American-made instrument, based on British design, which was introduced in 1946. It has found wide acceptance because of its accuracy and simplicity of operation.

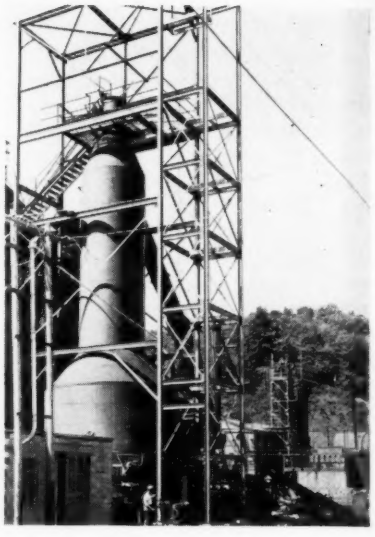
Installation of the web and batt forming equipment rounds out the department's facilities for research in bonded fibrous materials. The machinery reportedly is designed to produce garnetted fibrous webs and cross-laid mats up to 84" wide, such as are used in the manufacture of nonwoven goods and mats for insulations, stuffing, and filling purposes.

• Carbon Disulfide Manufacturing Facilities Nearing Completion at Penn Yan, N Y

New carbon disulfide manufacturing facilities, reportedly costing more than $500,000, are nearing completion at the plant of the Taylor Chemical Division, J T Baker Chemical Co, Penn Yan, N Y.

The facilities are part of a long-range expansion and modernization program designed to meet the needs of the rayon and rubber industries, among others, as well as the manufacturers of dyestuffs, carbon tetrachloride, insecticides, and cellophane.

Focal point of the new equipment is a recently-erected $100,000 electrothermal furnace, an addition to the three other furnaces now in use. Also included in the program are improved storage and handling facilities—to increase safety—and a new unit built especially to recover sulfur from waste gases.



A focal point of the Taylor Chemical Division's expansion program is this new electrothermal furnace at Penn Yan, N Y.

The Penn Yan plant reportedly was the first to produce carbon disulfide in commercial quantities by the electrothermal process—a process in which molten sulfur and lump charcoal are reacted within a huge electric furnace. Carbon disulfide is stored under water and transferred to tank cars and drums by displacement with water.

Marion W Smith, president, explains that the expansion at Penn Yan is part of Baker's $3,000,000 modernization program started in 1950, and scheduled to be completed this year. Baker's main plant is at Phillipsburg, N J.

• Maryland Governor Addresses 26th DCAT Dinner

2400 representatives of the drug, chemical and related industries throughout the country attended the 26th Annual Dinner of the Drug, Chemical and Allied Trades Section of the New York Board of Trade (DCAT) at the Waldorf-Astoria Thursday evening, March 6th.

The principal speaker was the Honorable Theodore R McKeldin, Governor of the State of Maryland, whose subject was "What Is Our Goal?".

Charles M Macauley, Charles M Macauley & Associates, Chairman of the DCAT, presided. Seated on the dais were officers of the leading national associations in the drug, chemical and related industries.

The DCAT is composed of 700 firms representing sixteen categories of the drug, chemical, cosmetic and allied trades.

• New Charlotte Office and Warehouse for Rohm & Haas

A one-story building comprising 12,000 square feet of floor area houses the new office and warehouse facilities of the Rohm & Haas Company at Charlotte, N C.

The newly-opened warehouse reportedly provides for both drum storage and bulk storage of the Rohm & Haas chemicals, resins, adhesives, enzymes, and detergents. Cold storage facilities are also provided.

Service on such products as the Lykopon and Formopon reducing agents (used in vat dyeing), the Rhonite and Rhoplex textile finishes, and the Rhozyme desizing agents will be vastly improved with the new facilities, it is expected. A number of other products manufactured by Rohm & Haas reportedly will be stocked at Charlotte, including the Triton series of detergents and wetting agents and the Uformite resins, strength agents for paper and adhesives. A resin of this series, Uformite 435, is now available in tank truck quantities as the result of the new bulk storage and loading facilities, it is learned.

The Charlotte warehouse augments service supplied by Rohm & Haas distributing points at Louisville, Knoxville, and Chattanooga. The offices serve as headquarters for Rohm & Haas' representatives in the Southern area. The entire operation is under the direction of P H Del Plaine, who also serves as Southern District Sales Manager of the Textile Chemicals Department. Other representatives working out of the Charlotte offices are W A Wardell, Russell G Lawrence, and C L Smith.

• Garment Dyers Re-elect Entire Board

The entire staff of officers and directors of the Garment Dyers Guild of America was re-elected recently in connection with the annual convention of the National Institute of Cleaners and Dyers in St Louis.

Walter Loebl continues as president, Fred Nuttall retains his vice presidency, and John Egli remains as secretary-treasurer. Stanley Simon and Leon Teichner (a past president) continue to serve on the Board. Allen J Copeland, whose Chicago advertising agency handles the Guild's account, continues to serve as executive secretary.

• Fischer Film on Analytical Balance

A 13-minute, 16 mm sound-film, "The Analytical Balance and Its Use," produced by the University of Illinois with the cooperation of Fischer Scientific Company, is currently filling a need for mass demonstration of the proper operation and correct technique involved in the use of this basic laboratory tool.

Topics discussed in the film include the construction of the balance; theory of balance swing and practical determination of rest points; weighing; and special types of balances.

Inquiries concerning prints ($60.00 each) or rental ($4.00) may be addressed to L V Peterson, 119 Gregory Hall, U of Illinois, Urbana, Ill.

• New Patent Abstract Service Inaugurated

Picturesort Company, 246 Church Street, New Haven 10, Conn, is now supplying photographic copies of patent abstracts weekly, as issued in the Official Patent Gazette.

The system has two important new features: 1) the subscriber gets only class and sub-class or type of patent in which he is interested and 2) abstracts are reproduced full size on 4 x 6 cards, punched for instant sorting.

• ATE Changes Name

American Textile Engineering, Inc, Arlington, N J, have changed their name to Canusa Plant-Equipment Corporation. C F Dulken continues as its president and C F Egues has been appointed vice president in charge of sales. The name-change reportedly is prompted by the company's widened scope of activities.

• Three Textron Scholarships at PTI

Three scholarships to Philadelphia Textile Institute have been awarded by the Textron Foundation, Providence, R I, it is learned. Three Philadelphia boys were the recipients: Joseph W Lynch, Ralph A Stanziola, and Stanley J Zankman.

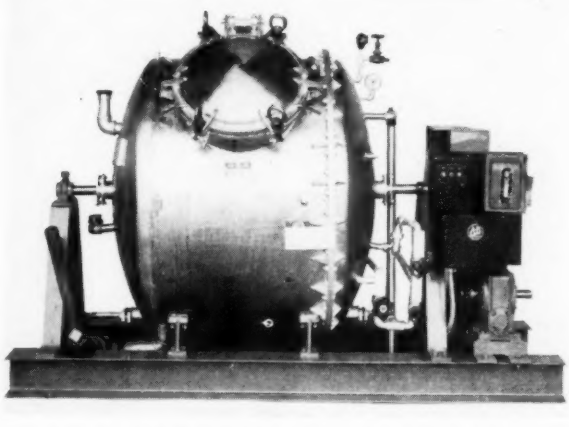
The Scholarships reportedly total $1800, providing $600 for each boy for the current 1951-52 school year.

NEW PRODUCTS AND DEVELOPMENTS

• Gaston County Perfects High Temperature-Pressure Rotary Dyeing Machine

A rotary dyeing machine, especially designed for piece-dyeing Orlon, nylon, and Dacron knitted goods, has reportedly been perfected by The Gaston County Dyeing Machine Company, Stanley, N C, and is now being used successfully by several hosiery mills, it is learned.

This is believed to be the first successful dyer built primarily to withstand the extreme temperatures necessary in handling these synthetic yarns. Reports from present users are said to indicate that the equipment operates successfully and safely at a high temperature range of from 212-300° F, and withstands the high pressures required.



Gaston County High Temperature-Pressure Rotary Dyeing Machine

Special features of the new dyer, which distinguish it from the open-type machine now in general use at hosiery mills, include an enclosed dyeing chamber, shut off from the atmosphere; faster indirect heating for dye bath; and extra-rigid construction features. The machine is of stainless steel construction. Patent is pending.

Although the rotary dyer is designed to operate at high temperatures and pressures, it is pointed out that it is not limited to these conditions; it reportedly may be used with equal efficiency at conventional temperatures. Models are available with capacities of 50, 100 and 200 pounds.

• Cyanamid Offers Two New Products in Trial Lots

American Cyanamid Company announced last month that it has made two new products available in trial lot quantities for evaluation in the chemical and allied trades — N,N'-Methylenebisacrylamide, a reactive, bifunctional monomer which undergoes reactions typical of its vinyl and amide groups, and 3-Aminopropanol, an amino alcohol similar to those having primary amino and hydroxyl groups.

N,N'-Methylene bisacrylamide is said to copolymerize with such monomers as ethylene sulfonic acid, acrylic acid and chloromaleic acid to yield cross-linked, insoluble resins. Products having similar properties may also be obtained by reaction with polyester resins, it is stated. Simple addition to the double bonds occurs with secondary amines to give mixtures of mono- and diaminated products, it is stated. It also is said to react with formaldehyde to yield a product that can be cured to a hard film. Its use as a cross-linking agent with other vinyl monomers is particularly interesting.

The three-carbon separation between the two groups in 3-Aminopropanol is said to result in behavior more typical of the individual groups than is found in currently-available amino alcohols. Cyanamid suggests that this product be investigated for use in the synthesis of soaps and other surface-active-agents, dyestuffs, resins, and pharmaceuticals. New Product Bulletin No 25 describes its properties. Write to New Product Development Dept, American Cyanamid Co, 30 Rockefeller Plaza, New York 20, N Y.

• Arilan* Dyes for Wool

For dyeing wool, Interchemical Corporation, Hawthorne, N J, recommends its new line of metallized acid dyes. Known as Arilan Dyes, these new products are said to provide brilliant shades of excellent all-round fastness. They reportedly are particularly suitable for dyeing a wide range of shades from pastels to deep, rich tones on loose wool or slubbing; yarns for carpets, rugs, sweaters, bathing suits and hosiery; felt for hats; woolen and worsted piece goods for sportswear, dress goods, suitings and neckwear.

Arilan Dyes are said to be simple to apply with mordanting or neutralizing of carbonized material unnecessary. Rinsing reportedly is the only predyeing treatment necessary. They are also said to build up on tone (providing better shade control), dye level, penetrate well, and possess excellent fastness to light washing, perspiration, sea water, carbonizing and fulling.

* Trade name for Interchem® Dyes of the metallized type.

(Above) A P Support with 6 Holes in Center Bar
(Right) Stor-Safe Tray (Cat No 1471)

• Laboratory Industries Adds to Equipment Line

Laboratory Industries, Inc, 4710 West North Ave, Chicago 39, Ill, has added two new items to their laboratory equipment line, Stor-Safe Trays and A P (all-position) Supports.

The Stor-Safe Trays, in 2 sizes, offer a convenient and safe method of storing and handling thermometers, hydrometers, volumetric and measuring pipettes. Cat No 1470 ($9.95) reportedly holds 8 thermometers or measuring pipettes up to 16½" long or volumetric pipettes up to 5 ml, while Cat No 1471 ($12.95) holds 4 hydrometers or volumetric pipettes including 50 ml capacity.

All trays have 3 sets of finger cutouts to facilitate removal of glassware. Entire tray is completely covered with Neoprene latex, providing a soft cushion for the glassware. Grooves are deep for full protection, so that trays may be stacked on each other.

The A P (all position) support is a strong rigid aluminum base, drilled to accommodate ½" support rods and designed for greater flexibility and rigidity for any multiple glassware setup. Since the rod holes are spaced on 5" centers the A P Support is particularly suitable for extractions and distillations. Available in three sizes with 6, 8 or 12 holes in center bar. Respective prices: 21, 28 and 40 dollars.

• Syntho-Softener C

Syntho-Softener C, a substantive product in the form of a highly-concentrated white paste, is the latest development in the Syntho-Softener series of softening agents being marketed by The Hart Products Corporation, 1440 Broadway, New York 18, New York. Syntho-Softener C reportedly assures a durable, soft, full, mellow hand with maximum draping qualities for all types of cotton, rayon, acetate, Bemberg, linen and nylon fabrics. The use of this product is said to avoid the disadvantages of the cation-active finishes. It may be used on whites with no yellowing and particularly on colored goods since it does not affect the color or light fastness of dyed goods or prints, the manufacturer states.

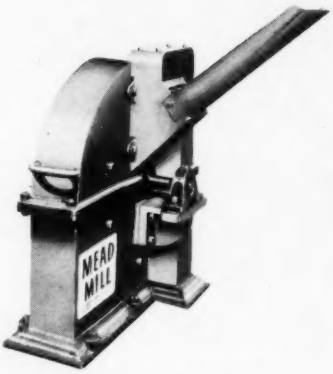
Syntho-Softener C reportedly will not cause mark-offs, odors, or rancidity. It is easily applied in the usual way in the pad, jig, dyebeck, or quetsch; shows no discoloration on pressing or aging of the goods; and will exhaust in long baths to give economical application, it is reported.

• New "Pony" Mead Mill

The newest addition to the Mead Mill line (Mead Mill Company, 14620 East Seven Mile Rd, Detroit 5, Mich) is the mobile "Pony" model, a pulverizing unit powered by a 1 hp motor with an output of 50-100 pounds per hour. It reportedly will pulverize any dry, grindable material to specifications without damaging molecular structure.

The Mead Mill is an impact-type pulverizer, disintegration of the material being accomplished by throwing against impact surfaces and by impact of the material within itself during the process. The mill speed and fineness of screen used determines the size of grind for any given material.

Other models of the Mead Mill are reported available in sizes from 5 hp (with an output of 500 lb/hr) to 30 hp (with an output of 16,000 lb/hr). All models are either cast or welded steel construction, with the rote shaft mounted in flange-assembled ball bearings. Special mills are made of nonferrous metals.



"Pony" Model Mead Mill

• New Resin Finish Reduces Residual Shrinkage

Aquex, a new resin finishing material for synthetic fibers, reduces residual shrinkage to less than 2%, according to reports from the manufacturer, Aquex Development & Sales Corp, Whippany, N J.

E W Sweet, Aquex vice president and general manager, has stated that a series of production runs under actual mill conditions have proved that fabrics treated with Aquex not only are less subject to shrinkage than fabrics treated with surface resins on the market until now, but also stand under flat abrasion 2-3 times as long.

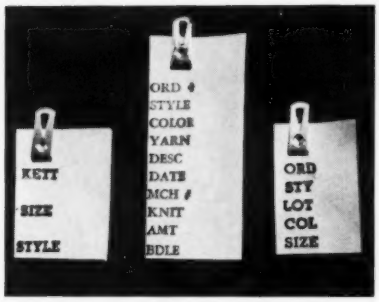
The product, a replacement for the surface resins, is combined with the usual thermosetting resins to form a new thermosetting resin in a thermoplastic state. It is technically described as a vinyl-acetate copolymer resin complex.

The plasticizing effect of the new resin is said to reduce damage of needle-cutting or burning. It is also said to provide a more durable finish when added to the nitrogen resins by locking in the finish. Combination with the ordinary monomeric resins reportedly reduces mark-off waste.

Versatility is another important feature of the product, which reportedly has been successfully applied to a wide variety of synthetics and blends from shirtings to suitings. Other features include its simplicity of application and improved bath stability.

When Aquex is used, it is claimed, only one draining a day is necessary in most circumstances, with any one formula being suitable for as many as 15 or 20 weights and weaves.

Aquex is being made available for general use with no restrictions by licensing or similar arrangement, it is learned.



Lok-Tite Marking Tags

• Lok-Tite Marking Tags

Liberty Marking Tag Co, 27 Hooper St, Brooklyn, N Y, has introduced a new marking tag for the textile trade of "super-tough" Permafiber stock, which reportedly withstands washing or processing with no visible effect or loss of markings. Supplementing the "Lok-Tite" tags, a rust-proof clip attaches instantly and holds fast to the goods without working loose or damaging them.

The tags, which have already proved successful to the laundry and dry cleaning trades, are available with special ink for all dyeing operations, according to the manufacturer. They reportedly can be printed and sized to order, suggested uses being for piece or garment identification, processing tags, price tags, size tags, instructions tags, etc.

Lok-Tite tags are said to come in ten fade-proof colors.

• Hunter Open Width Dye Kettle

James Hunter Machine Company, North Adams, Massachusetts has added a new open-width piece dye kettle to their line, primarily for dyeing pile fabrics and other face finish goods in open width plus other types of goods in rope form. Several of these kettles are now reported to be in successful operation in a large Pennsylvania mill.

The tank is said to conform to standard Hunter construction of #11 gauge, type #316 stainless steel with seams welded both inside and out. Safety-type enclosure doors slide downward below the floor line, thereby allowing steam to escape from the top as they begin to open.

Included as standard equipment are a bakelite spreader bar (to keep out wrinkles when running open-width goods), a built-in pin guide rail for goods in rope form, a spiral delivery roll, and a folder unit with stainless steel draw rolls driven by separate gear motor that may be run only when unloading to eliminate the usual belts or chains from delivery roll to main reel shaft. The gear motor drive has three speeds.

A special feature is a unique triangular reel with three tilting bars for supporting the goods (see illustration). Supported at their centers by a swivel mounting, the ends of the bars tend to slope in the opposite direction should the cloth work towards one end of the reel, thereby keeping the cloth centered.

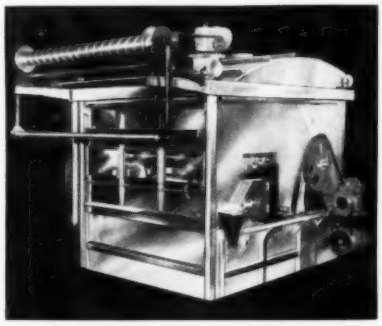
Extra equipment reportedly includes dye feeds, automatic controls, exhaust systems and other extras normally used for piece dye kettles.

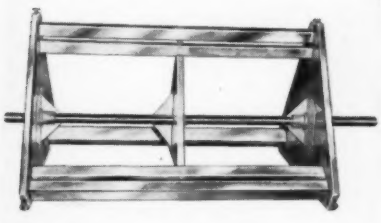
• New Birch Heavy Squeeze Roll Unit

A new heavy squeeze roll unit for fabric up to 50" face which may also be used for padding, has been announced by Harold W Birch, manager, Birch Brothers, Inc, 32 Kent Street, Somerville 43, Mass. The machine is said to be fitted with a top rubber-covered roll and a bottom stainless-steel roll, both of which are mounted in self-aligning spherical roller bearings of large size.

Pressure, ranging from 1-15 tons, may be applied by means of air cylinders with individual pressure controls for each cylinder. The drive is from a motor through a variable speed unit.

The manufacturer states that the machine is extremely rugged and is designed so that the rolls do not have to be crowned.





A special feature of the new James Hunter Open-Width Piece Dye Kettle (left) is a triangular reel with three tilting bars (right) for supporting the goods.

George W Ullman (second from left), president, and Ernest Nathan, vice-president, of the Sun Chemical Corporation, examine a swatch of Noraset-treated fabric. Herman Goldstein, manager of production and research, and Donald Gagliardi, director of the development laboratories of the Warwick Chemical Company Division, look on.

Left to Right: Carl E Foss, Paul O Blackmore, and Dr Forrest L Dimmick

• Discovery of New Hydrophobic Resins Seen as Major Advance

The discovery of new hydrophobic resins which reportedly impart in one product and in a single textile finishing operation several extremely desirable effects, was announced earlier this month by Ernest Nathan, vice president of the Sun Chemical Corporation. This entirely new class of compounds, referred to as Noraset, is said to impart durable water repellence, durable spot and stain resistance, durable crush resistance, and durable shrink resistance. They will be marketed by Sun's Warwick Chemical Company Division, it is learned.

The resins reportedly can be applied on practically all synthetics and it is also claimed possible to get a dry wool-like hand on rayon and rayon-blended fabrics with them. They may be applied on regular finishing plant equipment and are not particularly sensitive to curing, it is pointed out.

Fabric porosity is apparently unaffected and on the basis of laboratory tests, abrasion resistance is increased 200-400%, it is stated. Even more pronounced effects are said to have been observed in wet abrasion tests.

It is assumed that greater fashion possibilities in viscose rayon will also be possible through the use of Noraset as this product improves the washability of that type fabric.

Mr Nathan has stressed that the Noraset products are not simply mixtures of resins and water repellents, but are in themselves hydrophobic polymers. Further announcements on the applications of these products in other fields are expected in the near future.

• New Test Determines Color Matching Ability

A new test for determining the color matching ability of prospective job candidates was unveiled by the Federation of Paint and Varnish Production Clubs at the Color Exhibit held in connection with the annual meeting of the Intersociety Color Council at the Hotel Statler in New York on February 7-9.

The Color Aptitude Test Committee of the Intersociety Color Council, headed jointly by Carl E Foss and Dr Forrest L Dimmick, has been developing the test and gathering performance data on earlier editions for over ten years. The present edition reportedly incorporates new features in design and technological improvements that were indicated by past experience.

The "Test", in its present form, consists of an easel on which are mounted 48 color chips in four rows of twelve each. The rows are red, yellow, green, and blue and the twelve chips in each row vary in purity by about two steps in chroma over the entire series, or about one-sixth of a step between any two chips in the series. The chips are mounted in random order so that each color match must be an individual decision.

An automatic chip dispenser containing a duplicate set of chips is provided which allows the candidate to have only one chip at a time in his possession, and insures proper maintenance of sequence so that each candidate makes the matches in exactly the same order. Under each chip on the easel is an open square through which the candidate marks the number of the appropriate chip from the dispenser on the score sheet inserted underneath. The chips are made of acrylic plastic sheet coated on the back with an enamel made of permanent pigments dispersed in an acrylic vehicle. The chips are then backed with grey felt, thus assuring long time permanence of color.

Known as the "Intersociety Color Council Color Aptitude Test", the new edition was made possible through funds appropriated by the Federation through its Research Committee, headed by Paul O Blackmore.

Following the accumulation of enough data to assure adequate validation, the Federation plans to produce the Color Aptitude Test and make it commercially available to anyone interested. Production will be carried on under the control and complete approval of the Intersociety Color Council. Present goals call for production in quantity by the end of the summer.

Persons interested in additional information may write for the "Color Aptitude Test Bulletin". Letters should be addressed to the Federation of Paint and Varnish Production Clubs, 1524 Chestnut St, Philadelphia 2, Pa, attention of C Homer Flynn, Executive Secretary.

• New Antara Stripping Agent

Peregal ST, a new stripping agent for vat sulfur and direct dyeings, is now commercially available through the Antara Chemicals Division of General Dyestuff Corporation, 435 Hudson St, New York 14, N Y. Comparison tests have indicated that this new colloidal dye-sequestering agent, which stems from Antara's acetylene chemical program, is 10 times as effective as other agents considered excellent until now, the manufacturer states.

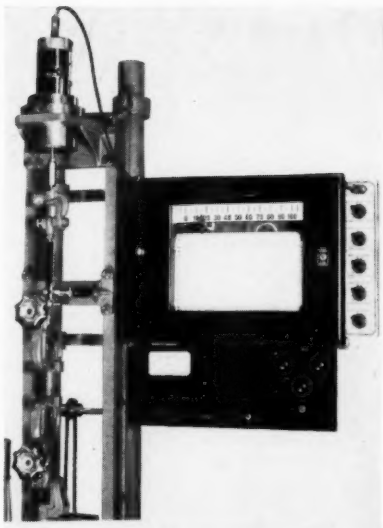
As a weakly cationic material, Peregal ST is said to form very stable cation-anion complexes with dyestuffs containing sulfo groups, or phenolate groups in aqueous solution. In stripping operations, once the fiber-dyestuff bond is broken, the dislodged dye is said to be preferentially bound to the Peregal ST, for which it has greater affinity than for cellulose. Even after prolonged treatment this equilibrium cannot be shifted toward dyestuff-on-cotton, it is stated.

• "Inertialess" Weighing System Applicable to Scott Testers

Scott Testers, Inc, 163 Blackstone St, Providence, R I, recently announced an entirely new electrical weighing system for application to existing Scott Testers of the pendulum type. The system is said to replace the conventional pendulum type head and recorder, converting the tester from constant-speed-of-pull operation to constant-rate-of-extension.

Resistance of the specimen, or load, is absorbed by the deflection of an elastic spool, which is converted to a voltage and measured by a potentiometer with recording chart. On the chart, extension of the specimen is shown vertically and load horizontally. Inasmuch as chart speed and clamp speed are both time functions, the chart becomes a stress-strain diagram directly, with either variable (load or extension) magnified or condensed as desired.

Advantages of the Scott Inertialess Weighing System are said to include the following: 1) Inertia is practically eliminated from the weighing mechanism. The improved sensitivity reflects the behavior of the specimen in more minute detail, particularly when minute changes are magnified as described above. 2) It is now possible to apply a constant rate of extension. 3) The flexibility of drive and recorder rates and wide range of chart speeds available permits new studies of progressive test stages.



Scott Tester Employing New Weighing System

Application of the new System to existing Scott Testers is said to be extremely simple on Models J, L, Q and X-3. The replacement reportedly requires about a half hour, consisting of removing the pendulum head by loosening four bolts and installing the new elastic spool head with the same four bolts. With equal ease, the potentiometer recorder replaces the old recorder, it is stated. Current is applied by plugging into any 110-120V AC outlet.

In operation, the specimen is inserted in the tester clamps in the usual manner, and the chart pointer adjusted to zero for the existing tare load. The driving mechanism is then set in motion, extending the specimen by moving the lower clamp downward at a uniform predetermined rate of speed. At the same time, by synchronized automatic action, the chart paper commences its downward travel at its predetermined speed. For literal stretch recording, the speed of travel of the chart can be equalized with the speed of travel of the moving clamp, it is stated. Travel speeds of .1" to 20" per minute are presently available.

As the specimen is extended, the elastic spool in the head weighs the load by its deflection, which is reflected in the horizontal scale, graduated from 0 to 100. The maximum deflection of the elastic member under maximum lb load plus tare, is said to be .0015", so that this has no practical effect on the recorded extension of the specimen. The accuracy of the system is listed as ¼ of one per cent of the span, or better.

Conversions are reported available from 2-to-10 lbs to 400-to-2,000 lbs. The change from one capacity to another is accomplished by changing the elastic member.

NAMES IN THE NEWS

Leonard Shapiro

LEONARD SHAPIRO has been named manager of the American Polymer Corporation's newly-established Textile Division. The Division reportedly will include textile research and application laboratories, which will explore textile application of APC synthetic resins as basic raw materials for manufacturers of textile auxiliaries.

Mr Shapiro is prominent in the industry for his work on textile resins, shrinkage-control processes, water repellents, and surface-active agents. In the past, he has been research director successively for Interlaken Mills, Warwick Chemical Co, Alrose Chemical Co and Synthron, Inc.

THE sales activities of Rodney Hunt Machine Company's five product divisions have been coordinated under B M JONES, newly appointed General Sales Manager. Primary responsibility of division managers is now defined by the Company as: product development, merchandising, and technical service to customers. Engineering personnel has also been centralized and expanded under H H BELCHER's new office of Director of Engineering, the Company reports.

B M Jones

H H Belcher

With appointment of Mr Jones, recently sales manager of the Textile Machinery Division, his former assistant H F CREEGAN, has been named manager, Textile

H F Creegan

D A Kuniholm

Machinery Division.

D A KUNIHOLM, formerly assistant sales manager of the Industrial Roll Division, has also been named manager. W J SIMONDS, former manager, has been made assistant to the executive vice-president, E F HARRIS. Managers were also appointed for the Company's Process Equipment, Water Controlling Apparatus, and Water Power Equipment divisions.

GEORGE L ARMOUR, president of American Aniline Products, Inc, has announced that HERMAN P BAUMANN has been appointed technical director of the Company's Metropolitan Application Laboratories at 116 Washington Avenue, Hawthorne, N J.

Long active in the textile industry, Mr Baumann spent many years in the field of dyestuffs following his college career, including several years of education and training in Europe. His most recent connections have been as chief chemist for Allied Textile Printers and the United Piece Dye Works.

Mr Baumann is noted for several translations from the German of the works of Dr L Diserens, renowned authority on dyeing and printing. In addition to his other duties, Mr Baumann is an instructor in textile chemistry at Fairleigh Dickinson College.

His office will be at the Hawthorne laboratories.

H P Baumann

THE appointment of Dr ALBERT F SMITH as director of the Carothers Research Laboratory of the Textile Fibers Department was announced recently by the Du Pont Company. The Carothers Research Laboratory, which is located at the company's Experimental Station in Wilmington, conducts a major portion of the research on nylon and "Dacron" polyester fiber.

Dr CHARLES H ARRINGTON, JR has been named to succeed Dr Smith as a research supervisor in the Chemical Department at the Station.

Dr Smith, who is 38 years old, has been with Du Pont since 1936, when he joined the company as a chemist in the Chemical Department at the Experimental Station. He was promoted to research supervisor there in 1939.

OBITUARY

WILLIAM S CALCOTT

WILLIAM S CALCOTT, special assistant to the director of the technical section of the Du Pont Company's Organic Chemicals Department, died on the morning of February 15 in the Graduate Hospital of the University of Pennsylvania. He was widely known as one of the nation's leading research chemists.

Chief among the many research investigations carried out under Dr Calcott's direction were indigo research, properties of materials for chemical plant equipment, the development of methods of analysis for organic mixtures, and the development of a process for the manufacture of tetraethyl lead. The latter, in which he collaborated with such prominent men as Thomas Midgely and Charles Kettering, proved to be one of his outstanding contributions. Another development in which he played an active part was that of neoprene.

Dr Calcott joined the Chemical Department of the Du Pont Company in 1915 as a research chemist at the Experimental

William S Calcott

Station, and two years later was assigned to the Dye Works (now the Chambers Works), Deepwater Point, N J. In 1918, he went to the Jackson Laboratory and while there became successively head of the General Organic Division in 1919, assistant director in 1929 and director in 1931. In 1943 he was promoted to assistant chemical director in charge of development, and in 1951 was named special assistant to the director of the Technical Section.

Dr Calcott's active interest in many aspects of chemistry was reflected in the many societies of which he held membership. He was long a member of the Philadelphia Section, AATCC.

WALTER J CROCKER

WALTER J CROCKER, 46, head of the Dyeing Department, Empire Worsted Mills, Inc, for the past ten years died suddenly on February 18th in a hospital in Jamestown, N Y.

NEW LITERATURE

Emkay Product List

Emkay Chemical Company
319-325 Second Street
Elizabeth, N J

Industrial uses are tabulated for each of the products listed in this 8-page pamphlet, as well as the chemical category into which each belongs. A brief description of the most popular specialties and their applications in textile, paper and leather processing completes the pamphlet.

Illco-way Bulletin P-30

Illinois Water Treatment Co
Rockford, Illinois
Available on request

Boiler-feed water treatment (ion exchange) is discussed in this 4-page folder. Information covering ion exchange equipment (including softeners, hydrogen-Zeolite, and deionizers) and the recently-developed Illco-Way Mixed Bed Deionizers is supplemented with installation views and data on Illco-Way equipment.

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